CAREERS 360

PREPARATION Series

NID DAT 2025

Full Study Material

CONTENTS

About This eBook

Dear Students,

We are excited to share that we have created an eBook for students preparing for the NID DAT BDes exam. This eBook is a comprehensive guide for students preparing for the NID DAT BDes exam. It includes detailed information on both the Prelims and Mains exam patterns, marking schemes, and types of questions. The Prelims section consists of multiple-choice and subjective questions, while the Mains focuses on hands-on tasks like drawing, sketching, and model making.

Additionally, the eBook covers the complete syllabus, organized into key areas:

- **Design Fundamentals:** Color theory, design development, and the relationship between mood, theme, and color.
- **Elements and Principles of Design:** Composition, form, function, and typography.
- **Visual Perception & Optical Effects:** Light, shade, optical illusions, and perspective.
- **Creative Development & Ideation:** Creative thinking, lateral thinking, and brainstorming techniques.
- **Imagination & Innovation:** Doodling, storytelling, and visual logic.
- **Practical Design Skills:** Sketching, 3D visualization, and presentation techniques.
- **Advanced Design Concepts:** Innovation, design awareness, and understanding good vs. bad design.
- **Thematic Design & Ornamentation:** Theme development, motifs, and cultural aspects of color.

This guide will equip students with the knowledge and skills needed to excel in the NID DAT exam.

NID DAT BDes Exam Pattern (Prelims And Mains)

Both the DAT Mains and Prelims are included in the NID DAT 2024 test format. The DAT Prelims will be a paper-and-pencil/pen exam with text and images, and the length of the examination will be indicated on the admit card. The tests assess the knowledge, abilities, and behavioral traits of the candidates. However, The DAT Mains entails a Studio Test. Students may be required to complete tasks such as sketching, building models, participating in group discussions, and presenting during the studio exam. The official NID DAT BDes prelims sample paper outlines the exam pattern as follows:

NID DAT BDes PRELIMS (40%)				
Section	**Type of question**	**Number of Questions in each section**	**Marks allotted per question**	**Maximum marks per section**
Part I	MCQ	Q1 - Q15 Q16- Q26 Q27	15 x 1 mark 11 x 2 marks 01 x 3 marks	15 marks 22 marks 3 marks
Part II	Subjective type	Q28 - Q31	4 x 15 marks	60 marks
Total Marks				**100 marks**

NID DAT BDes MAINS (60%)	
Mode of exam	Offline
Exam Duration	3 hours
Total marks	100
Mode of Language	English
Type of questions	Based on Drawing/ Sketching/ Model Making

NID DAT 2025 Syllabus

NID Patterns and Topics

CHAPTER	TOPIC	CONCEPTS
Non-Verbal Reasoning	Image Processing/ Visualisation Based	• Visual Series Completion (Image Identification) • Analytical Reasoning (Image based), Type & Fonts, Embedded Figures • Grouping of Images(Analysis, Conclusion, Relationship among given pictures) • Analogy (Visualisation and Interconnection Between Two images)
	Form-Based/ Understanding of Shapes/Forms	• Cubes/ Dice and Arrangement (Form Understanding, Positoning & Spatial Visualisation) • Water Image (Reflection and Distortion of Image) • Patterns & Symbol Coding/Decoding
	Others	• Mirror Image Based (Understanding of Alphabets, Shapes & Imagination Based) • Shapes Construction (Shape Visualisation, Geometric , Organic & Abstract Images)
Analytical & Logical Reasoning	Statement or Diagram Based	• Venn Diagrams/ Syllogism • Sitting Arrangements/ Blood Relations • Distance & Direction
	Others	• Number and Alphabet series • Data Sufficiency/ Blood Relations/ Decision making • Coding-Decoding Operations
Visual & Spatial Ability	Visualisation Practical/Theory	• Block Counting, Block Rotation, 2D & 3D Spatial Analysis, • Elementary Mechanical Ability(Gears/Pulleys/Springs etc) • Hidden figures (Figure And Ground Theory/ Gestalt Theory)
	Orthographic/ Isometric Projections	• Projection Based (Orthographic Projection -90 Degree) (Isometric Projection-30/45 Degree)

CHAPTER	TOPIC	CONCEPTS
Numerical Ability	Algebra Most Asked (Frequent Topics)	• Percentage/ Ration and Proprtion/ time & Work/ Time & Distance • SI & CI, Profit & Loss • Others (Pipe and Cisterns/ Trains and Directions/ Clocks, Calendars)
	Geometry Topics	• Fundamentals of Geomatry, Area/surface Area & Volume
Miscellaneous	General Awareness	• Art Movements: Indian Painters & Paintings, Painting Styles and Techniques, Top 50 paintings, Indian Traditional Painitng styles, • Color Theory (Color Wheel, Primary Secondary & Tertiary Colors)* • Basics of Photography, Practical Application and Limitation
	Miscellaneous Biology/Physics Questions	• Walk & Run cycles of Different Animals/Humans • Fundamentals of Civics & Like Fundamental/Rights & Duties • Anatomy of Insects/Animals/ Humans (e.g. Wings of A drag-onfly asked in 2024) • Concepts of Simple Machines (Lever /Wheel & Axle, Plane and Inclination, pulley, Wheel & Screw)

List Of Topics For NID DAT 2025

Surface Counting - Basic Level
Surface Counting - Advanced Level
Mirror and Water Images
Basics of Photography: Introduction and Theory
Basics of Photography: Application and Principles
Color Theory (Color Wheel, Primary Secondary & Tertiary Colors)*
Spatial Ability - Block Counting
Walk and Run cycle
Mechanical Aptitude - 01 (Inclined Plane and Lever)
Mechanical Aptitude - 02 (Wedge, Pulleys & Springs)
Mechanical Aptitude - 03 (Wheel-Axle, Screw & Gears)
Top Paintings, Indian Traditional Painitng styles
Projection Based (Orthographic Projection -90 Degree) (Isometric Projection-30/45 Degree)
Animation Principles and Applications
Analytical Reasoning: Typography
Paper Folding /Unfolding, Paper Cutting and Unfolding
Fundamentals of Geomatry for 2D shapes
Fundamentals of Geomatry for 3D shapes
Analogy (Visualisation for Interconnection between Pieces and Parts)
Cubes and Dices
Data Sufficiency
Art Movements
Design Principles / Gestalt Theory

NID

Full Study Material

SURFACE COUNTING

Level 01: Basic

Surface counting is a visualisation-based exercise. Such questions are repeatedly asked in various entrance examinations, such as NID, UCEED/CEED/ NIFT, etc.

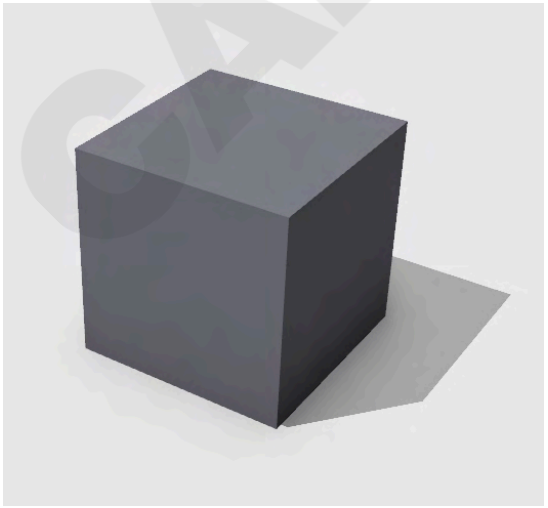
To build a strong visual and analytical perspective, design aspirants must master surface continuity. Every year, this ability is assessed in the DAT tests given by different organisations. The main goal is to evaluate the candidate's capacity for visualising and interpreting design aspects, essential for developing a strong visual memory and determining the proper interventions for a particular design solution.

INTRODUCTION

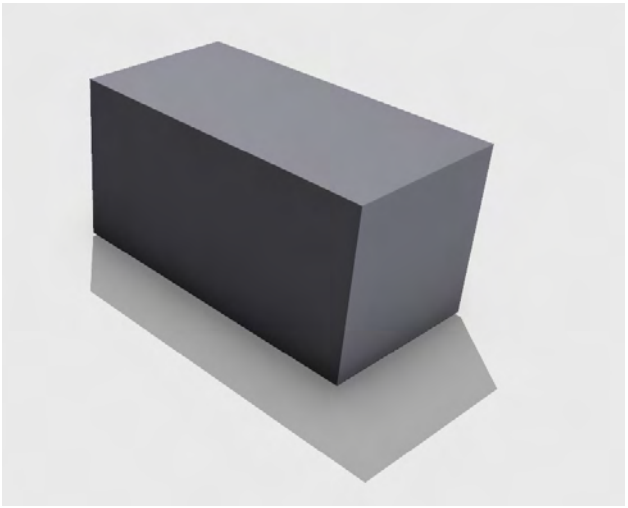
Surface counting involves counting the number of visible and invisible surfaces for a given three-dimensional arrangement. A three-dimensional arrangement could be a single entity or a combination of more than one three-dimensional volume with continuity or discontinuity in the surfaces, which we would go through next :

A. Discontinuous Surfaces : Cube and Cuboid

To understand the fundamentals of Surface Counting for 3D volumes, we will begin with the primary volumes like cubes and cuboids.



Cube (all sides are equal)



Cuboid (all sides are of different size)

Both cube and cuboid have 06 surfaces, considering the volumes length, width and height.

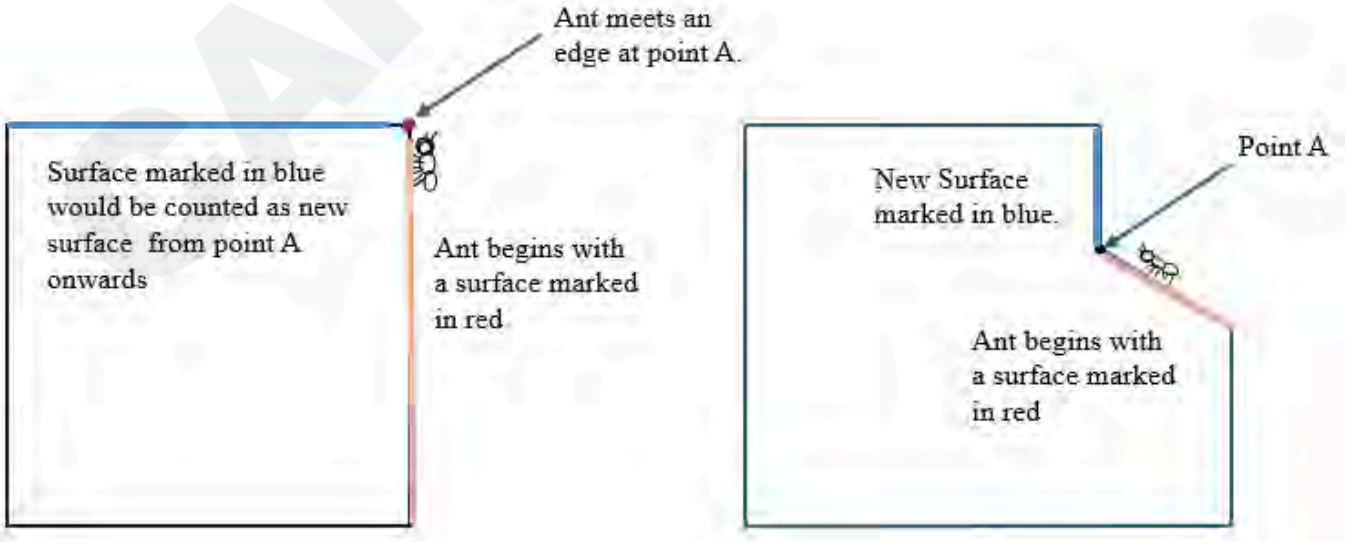
Top: 01
Bottom: 01
Sides: 04

Continuous Surface : Sphere

A sphere, even with an equal/smaller or greater volume than a cube, has one continuous surface.

Activity : How to Count the Surfaces ?

Trick: Suppose an ant starts travelling across a surface, at point A, it meets an edge while travelling the surface. From Here(point A), the surface would be counted as the second surface.



Concept 01: The **Ant Rule**

Imagine an ant travelling along the edges of a wall.

For the above figure, Count the Number of surfaces for the given volume, as inferred from the two given views using the "Ant Rule".

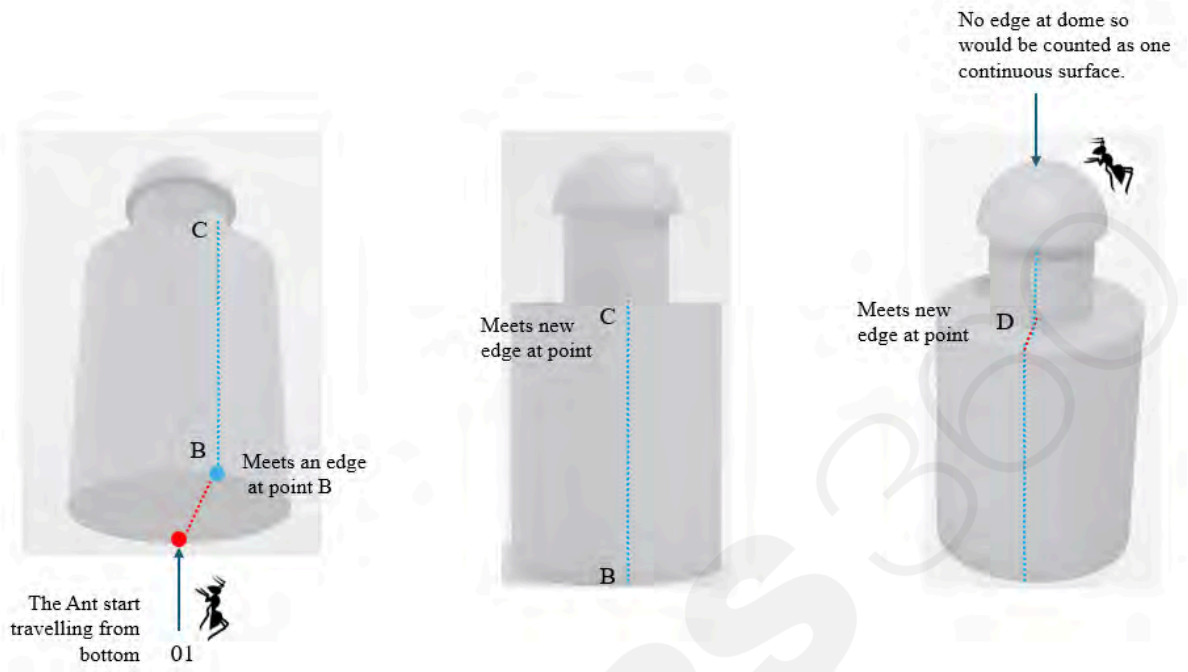
Solution: 06 Surfaces

Method: Ant travelling across the edges
Description: As per the **Ant Rule**, at every encounter of an edge, the following surface count would be a new surface.

To Start counting, we need to understand the logic for solving such questions.

Logic 01: **Continuity or discontinuity of a surface, marked by edge.** In a question, the figure may contain two or more geometric volumes combined, as simple as a combination of cubes to a complex combination of multiple volumes, as shown in the above figure, which combines cylinders and hemispheres. In such cases, the edge serves as a partition between two surfaces.

Understanding the Concept of Continuity and Discontinuity :

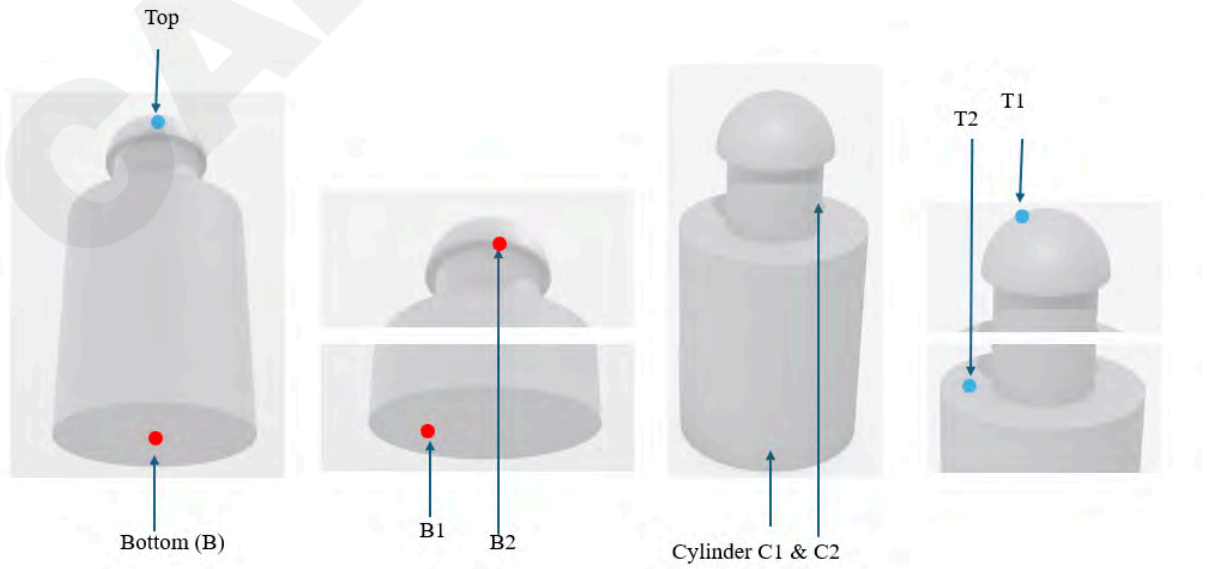


Logic 02: **Direction**

It is a good practice always to count all the surfaces visible from a given direction(like the top) out of 06 possible directions.

For example, all the surfaces visible from the top should be counted at a time in the figure, i.e., T1 & T2.

How To: Select a Direction to begin counting the surfaces.



Step-by-Step Approach to Solution

Step 01: Choose any one direction, only the Top or Only the bottom, to begin.
In the given figure, we start with the bottom approach.

Step 02: Count all the visible surfaces from the bottom, as shown in Figure 02

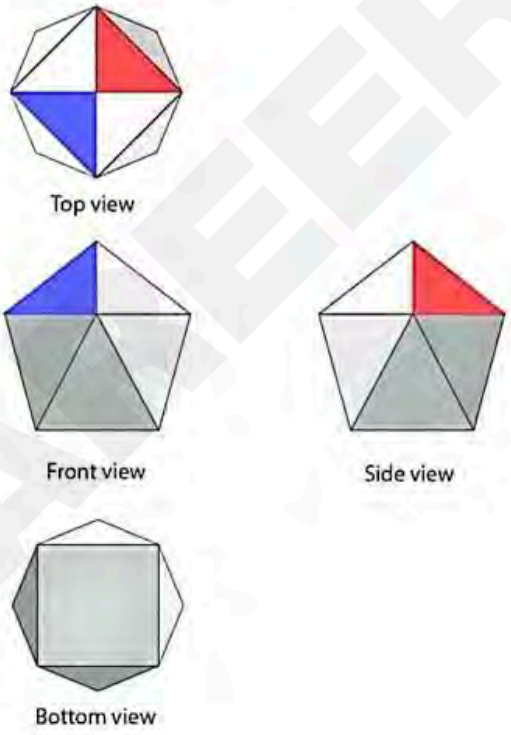
Step 03: Count all the Right-side surfaces. In this case of cylindrical surfaces, only C1 & C2

Step 04: Count all the visible surfaces from the top, in this case, T1 & T2

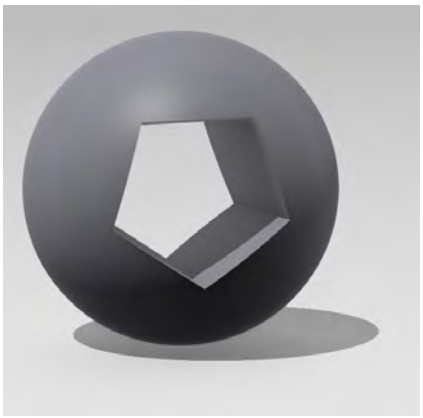
TOTAL SURFACES
B1+B2+C1+C2+T1+T2 = 6 surfaces

Practise Questions for Surface Counting:

Q1 Four views of a convex solid are shown. How many surfaces does the solid have? :

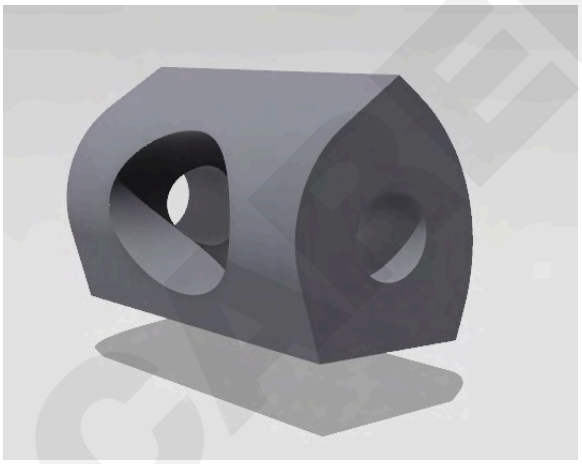


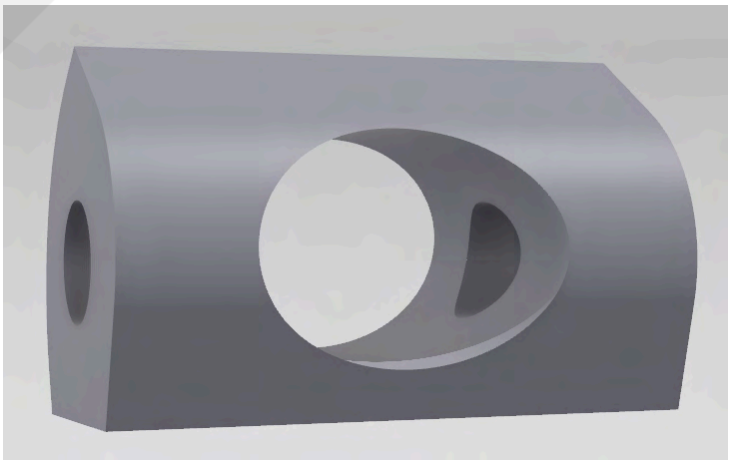
Q 2 : A pentagonal shape is cut out from the sphere for the given figure. Count the number of surfaces in the newly formed 3D volume.



Q 3 : From the Front, Right side and Perspective views for the given volume, Count the number of faces in the figure.

Hint: Count all the faces from one side in one go, e.g. counting all the visible surfaces from the right side view.





Important FAQs for Surface Counting.

1. For those aspiring to design as a career, why is surface counting important?
Surface counting is essential for those aspiring to design because it enhances spatial reasoning, imagination, and analytical skills—all necessary to pass design aptitude examinations.

2. What is the distinction between visible and invisible surfaces in surface counting?
Invisible surfaces are concealed from view but may be deduced from the general structure of the item. In contrast, visible surfaces are immediately visible from a particular angle.

SURFACE COUNTING

Level 02: Advanced

Understanding the surface through the Analytical Reasoning Approach.
In this article, we share the approach for counting the number of shapes in the given parent volume that consists of multiple sub-shapes/volumes, e.g. A stack of cubes is given, and some cubes are missing.

The focus is also on introducing the concept of platonic solids and their understanding from DAT examinations.

A. Introduction to Regular Polyhedron (Platonic Solids)

Platonic solids are a unique class of highly symmetric three-dimensional objects with equal faces, edges, and angles. The **Greek philosopher Plato gave these solids their namesake** and connected them to the elements of classical philosophy.

These volumes/solids are considered Platonic for the following properties.

1. Equilateral Faces: The dimensions and forms of every face are the same.
2. Equal Angles: Every internal angle is equal.
3. Vertices: An equal number of faces are joined by each vertex.
4. Every solid possesses a great degree of symmetry.

There are 05 types of fundamental Platonic Solids.

Tetrahedron: 04 faces in a triangle
Hexahedron or cube: 06 square faces
Octahedron: 08 equal faces
Dodecahedron: 12 faces in a pentagon
Icosahedron: 20 triangular faces

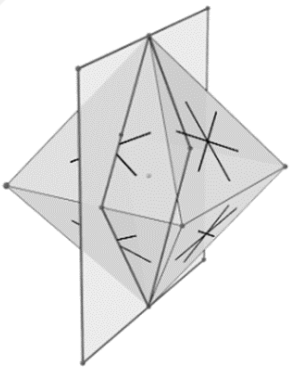
	Tetrahedron	Cube	Octahedron	Dodecahedron	Icosahedron
Platonic Solid					
Spherical Polyhedron					
F: Faces	4	6	8	12	20
p: Edges/face	3	4	3	5	3
q: Edges/vertex	3	3	4	3	5

B. Introduction to Symmetry and Asymmetry in the Compositions for Surface Counting.

Symmetrical Shapes

Symmetry refers to the shape's ability to be split into mirror-image segments or to remain unchanged when rotated around an axis. Because of their homogeneous and predictable characteristics, symmetric volumes are simpler to visualise and analyse.

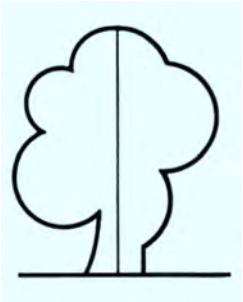
For example, as mentioned earlier, the tetrahedron, cube, octahedron, dodecahedron, and icosahedron are platonic solids. These shapes have equal faces, edges, and angles and are highly symmetrical.



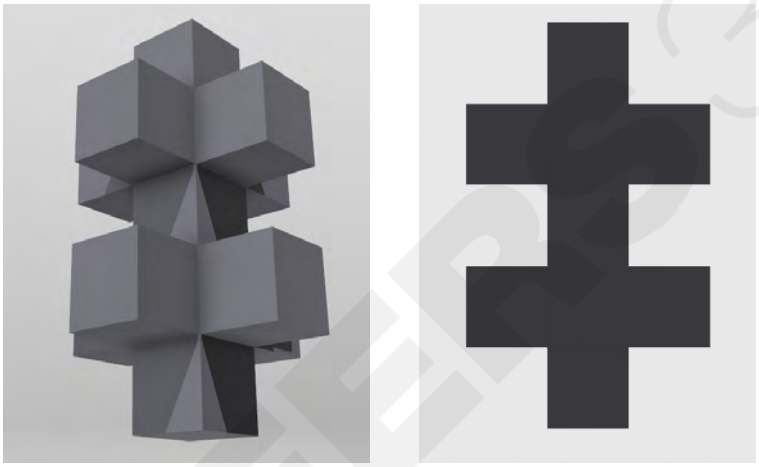
Asymmetric Shapes

Asymmetrical shapes are three-dimensional shapes that lack translational symmetry points, axes of rotation, and planes of reflection. Because of their irregular and unpredictable characteristics, asymmetric shapes are more challenging to understand and depict.

For example, organic volumes/shapes like rocks and trees are unlike most naturally occurring structures.

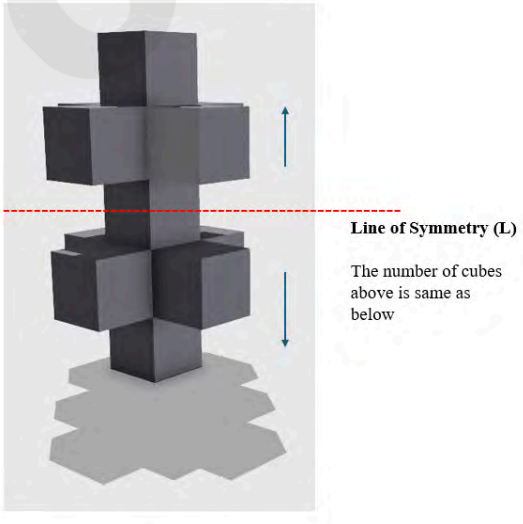


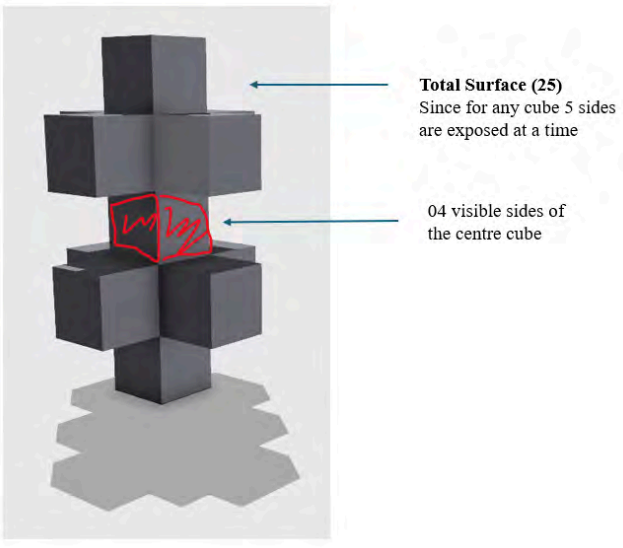
C. Visualising the Symmetry/Asymmetry in Surface Counting



Two views(Perspective and Right Side view) of the same object are given. Count the Number of Surfaces for the given shape.

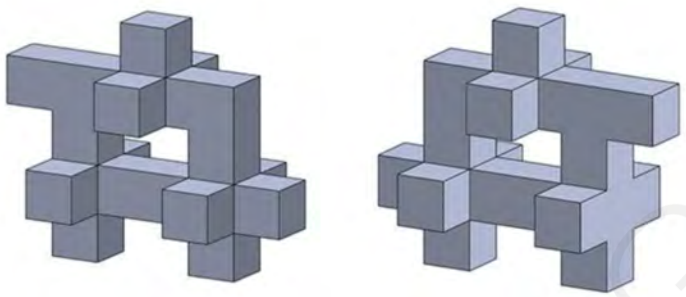
Solution: By marking a line from the middle, the shape provided can be divided from the centre, and thus it is symmetrical. This reduces the effort for counting the surfaces one by one instead of counting the surface from the centre and multiplying by two to count the total possible surfaces in such given volumes quickly.





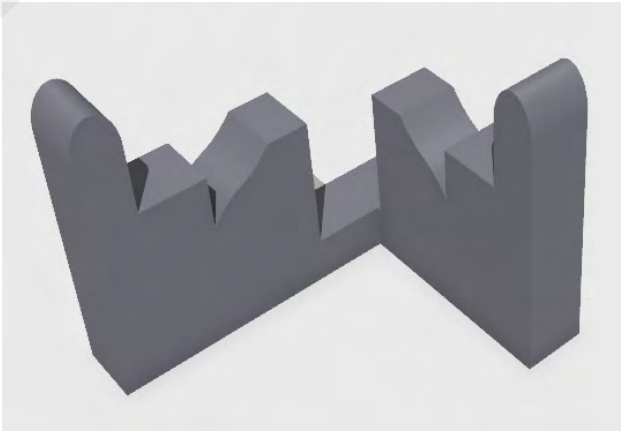
Total Exposed Surfaces = 25 X 2 (for both top and bottom) + 4 sides for centre cube
= 50+4
= 54 sides

Practise Question 01: Below are two views of the same object. Count the number of surfaces in the given shape.



Hint: Primarily check if a symmetry/asymmetry in shape is possible across any axis.
Count all faces in one direction at a time, like counting all the faces visible from the top.

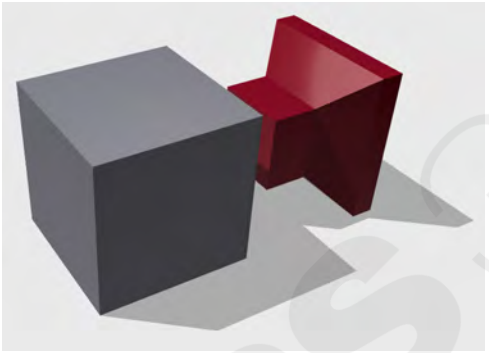
Practise Question 02: Two perspectives of the same solid, as shown below. Count the number of surfaces in the object, and consider the hidden faces flat.



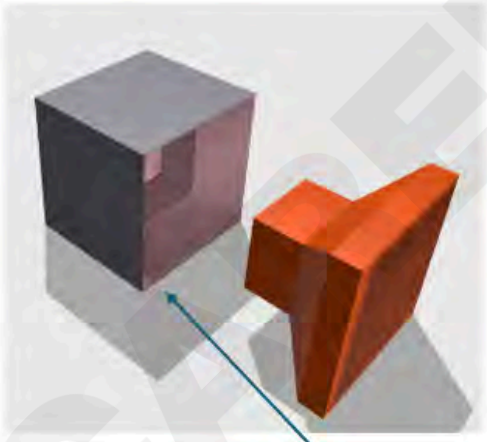
D. The surface formed by the Intersection of solids

In specific questions, a solid is given, and a part is cut out of the solid, thus exposing the new cut-out surfaces of the solid. **The candidate must count the new surfaces exposed/formed by this subtraction operation. The addition operation is also done to make new surfaces in some instances.**

Let us understand with the help of an example.

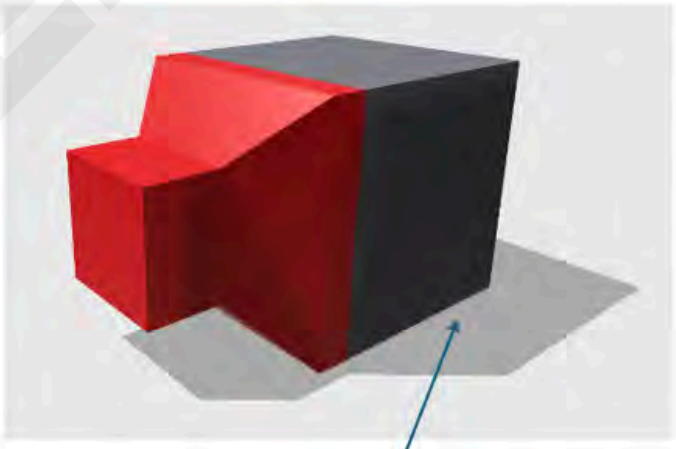


Parent figure



Subtraction Operation (14 surfaces)

By subtraction operation of in the cube there is a cavity formed exposing 9 new surfaces, and 5 original surfaces of the cubes making total 14 surfaces.

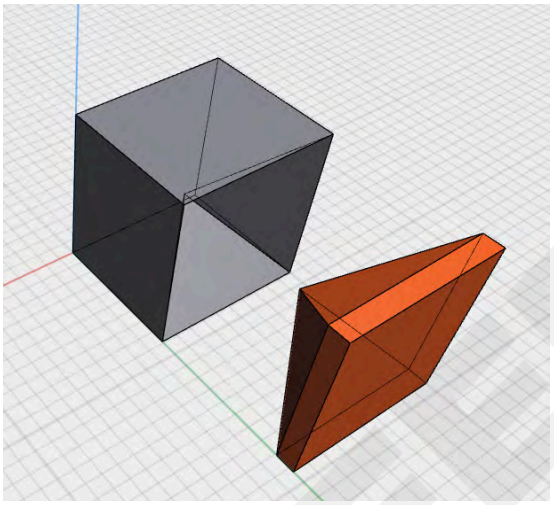


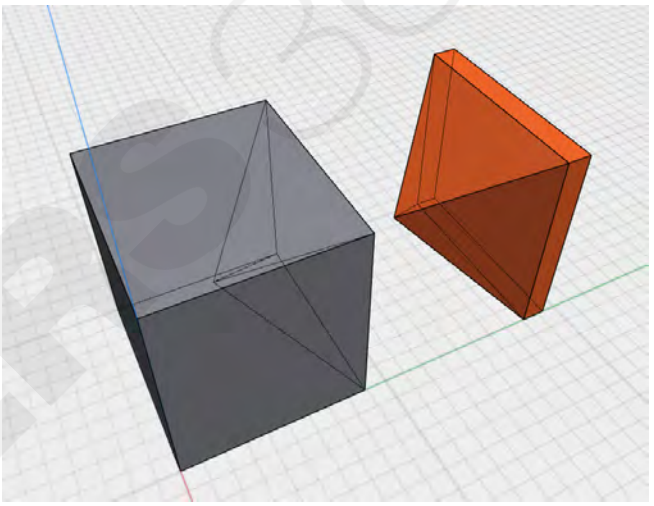
Addition Operation (18 surfaces)

By Addition operation of in the cube the bodies have combined to make in all together 18 surfaces on counting.

Practise Question for **Surace Intersections**

Ques 01 : From one side of a solid cube of each side 2 units, a square pyramid of height 1 unit was removed, as shown in the image, resulting in a solid(in grey color) with 9 surfaces. If one more pyramid of the same dimensions is removed from another side of the resultant solid, how many surfaces can the new resultant solid have?





Option A :10 Sides
Option B :11 Sides
Option C :12 Sides
Option D :13 Sides

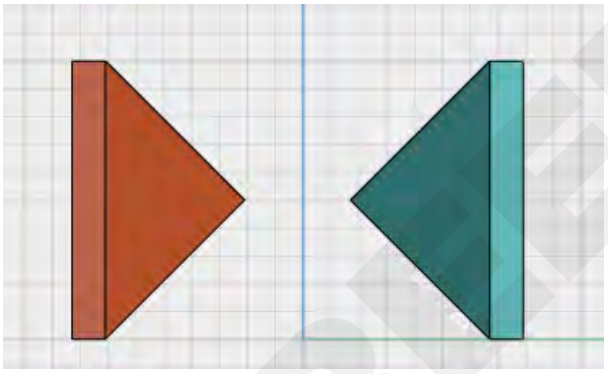
The solution will be provided in the next article, so stay tuned.

MIRROR & WATER IMAGE

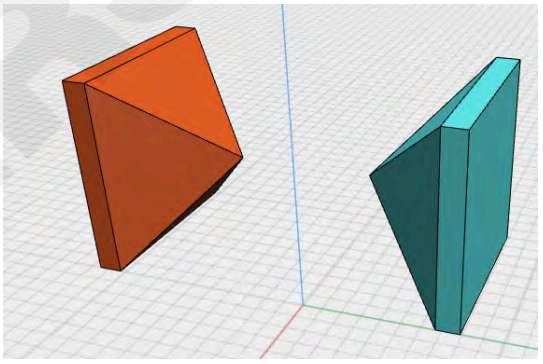
Introduction

Mirror and Water Images are frequently asked about in the Design DAT Examination, including the entrance examinations conducted by reputed design universities in India. This article will explore concepts like lateral inversion, vertical inversion, visualisation techniques, and symmetrical concepts for the mirror and water image. Once the fundamentals are cleared, these are two great Scoring Areas for any aspirant.

Mirror Image: When an observer looks at an object in a mirror, it is called a mirror image. **In this case, the original object has been inverted so that the left side is on the right side and the right side is on the left.**



Original Image **Mirror Image**



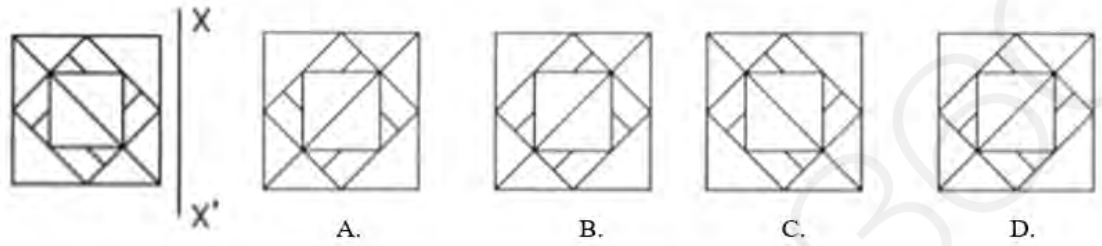
Original Image **Mirror Image**

Points to Note :

1. When we talk about mirror images, we consider the flat version of the mirror unless it is mentioned in the question.
2. The size of the object reflected never changes. Neither does it become bigger or smaller in the mirror image.
3. The object reflected as seen in glass is the same without any shift or divergence from the original form.

Sample Question

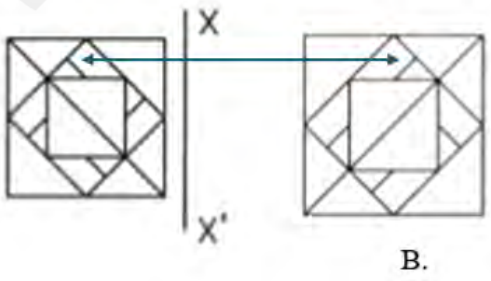
For the image on the left, find the correct mirror image using the given options.



Solution Approach:

Step 01: For most DAT examinations, never settle for the right option; rather, it is advised to a**dopt the "Elimination" approach,** rejecting the options that are fundamentally wrong to reach the right option**.**

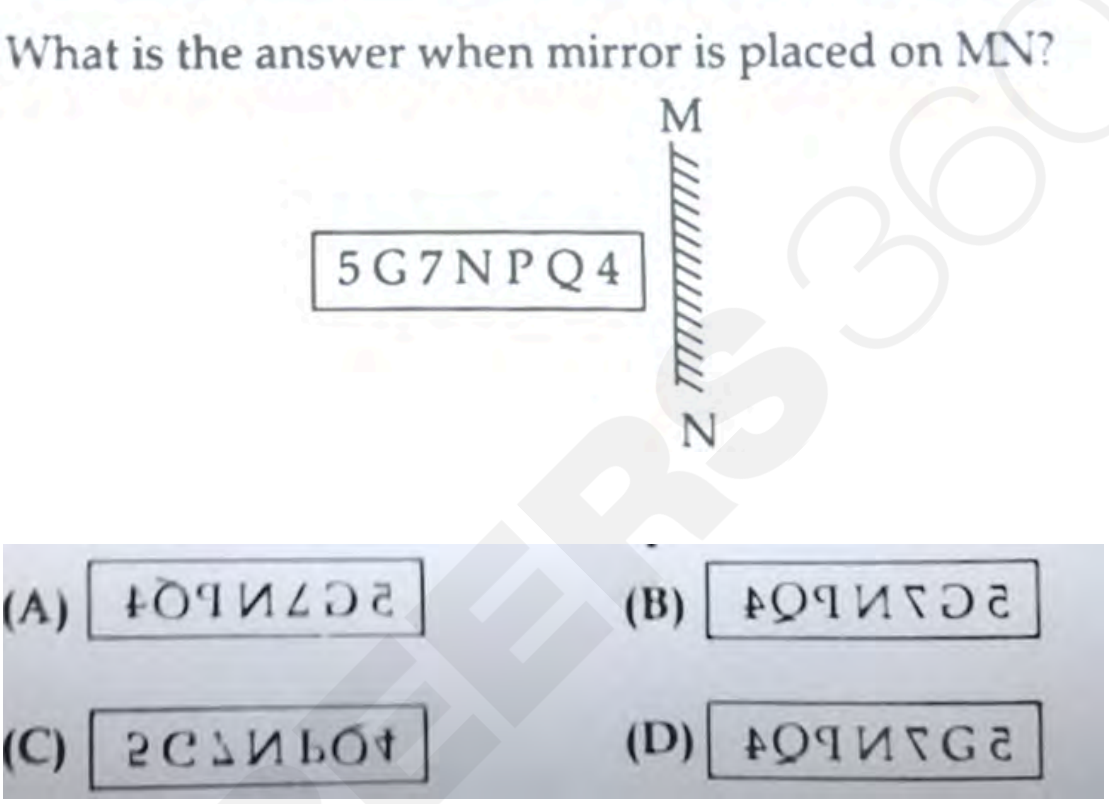
Step 02. The diagonal line is wrongly aligned in option C, eliminating option C. In option B, the indicated lines are parallel but not in question; the mentioned lines are not parallel, thus eliminating option B, as shown in the figure.



Step 03. Now, comparing options A & D itself , we see the inner square and the lines in the pattern inside the smaller square in option D are same as the question which is the not possible. Thus, the only option is left, and on cross-checking, we find that option (A) is correct.

Practise Questions: Mirror Image

Question 01: For a given image(alphanumeric code), find the correct option for the mirror image formed.



Water Image: When an observer looks at an object in water, the inverted form visible for the object is called a water image. Appearing as a vertically inverted version of the object, it shows symmetry along the horizontal axis (waterline)

Note: When we talk about water images, we consider the stand-still state of the water with no disturbance or discontinuity on the water surface.

Key points to understand:

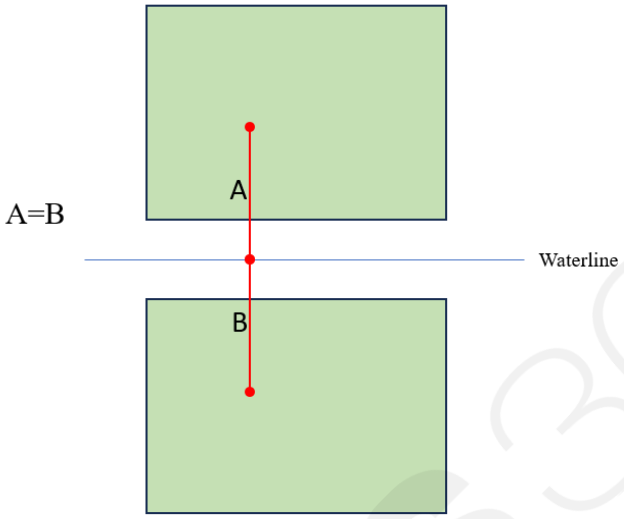
1. **Reflection Symmetry**: Water images show a reflection of the object, similar to a mirror placed horizontally at the waterline.
2. **Vertical Inversion**: The reflection is an inverted version of the object along the horizontal axis (upside down).
3. **Perspective and Depth**: Objects closer to the water surface appear larger and more detailed in their reflection, while those farther away appear smaller and less detailed.

How to identify the Water Image:

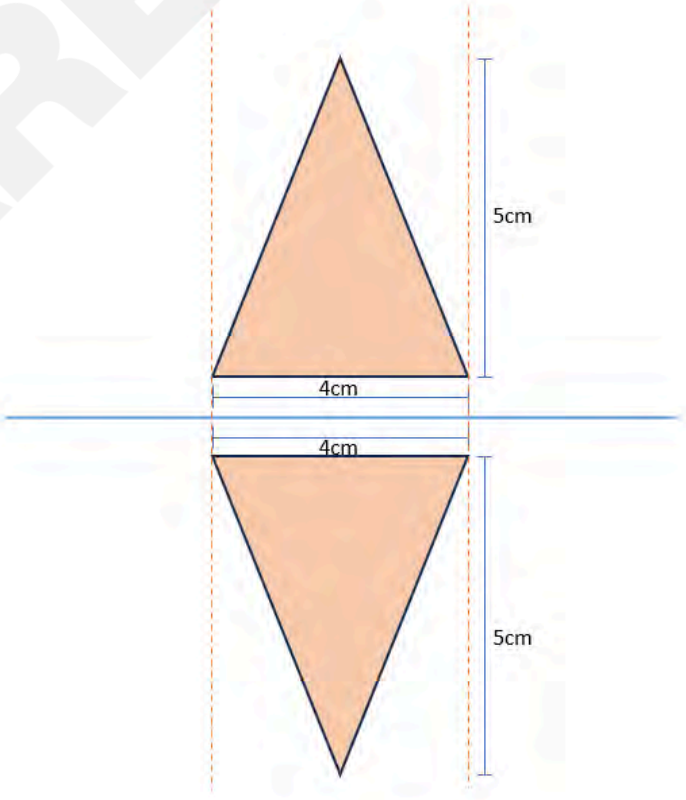
1. Check if the object appears flipped upside down along the horizontal axis **(waterline)**. For example, "2" should resemble a reversed "S" below the waterline.

2
S

2. Ensure that the **original object and its reflection are symmetrical relative** to the waterline. The distance from any point on the object to the waterline should be equal to the distance from the corresponding point on the reflection to the waterline.

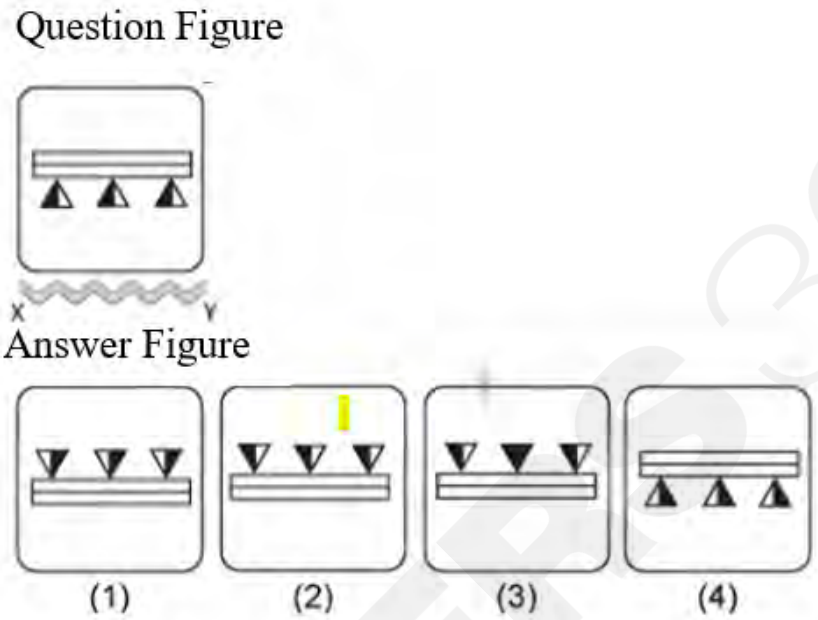


3. Verify that the reflected image **maintains the exact proportions and alignment as the original object**. For example, if the original object is a triangle pointing upwards, the reflection should be a triangle pointing downwards, maintaining the same base width and height.



Sample Question:

Choose the correct water image of the question figure from the given answer figures (assume that water is along XY)



Approach to Solution:

Step 01: We'll start by eliminating the option/s which is different from the question. Just like option (3), which comprises an element-middle black triangle, which is different from the middle triangle present in question and option (4), in which the image is as it is, only the black-shaded region is mirrored. Also, the whole part is not inverted.

Step 02: This leaves us with two options (1) and (2). We will compare the shaded black region with the question because the rest is the same. On comparing, we can see that the black shaded region is mirrored in option (1), it should be on the same side only just below.

Step 03: That can be seen in option (2). The correct answer is option (2).

Practice Questions:Water Image

Question 01: Choose the correct option that resembles the given combination's water image.

A1M3b

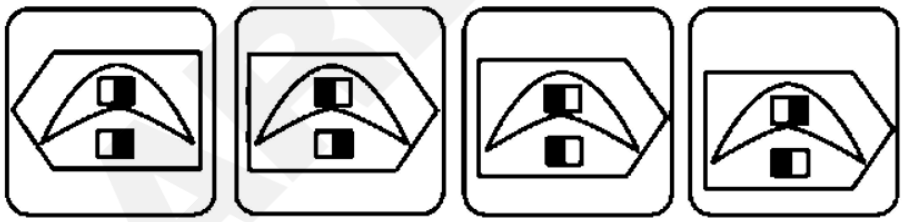
(1) ∀ıW3ᑭ (2) ∀ıW3ᑭ

(3) ∀ſW3ᑭ (4) ∀ſWƐᑭ

Question 02: Choose the correct water image of the question figure from the given answer figures (assume that water is along XY)

Question figure:

Answer figure:



(1) (2) (3) (4)

BASICS OF PHOTOGRAPHY

Photography is a powerful tool that plays a significant role in diverse design domains like Visual Storytelling, supporting the validation of points, enhancing presentations, capturing moments, etc. The knowledge of photography and understanding of techniques is not only practical from a theoretical point but also developing the concept for practical application.

History of Photography

The journey of photography started with the capture of light! Scientists have long known that a camera obscura may project images, acting as an organic projector. Then, in 1826, a pewter plate was used to take the first-ever permanent photo for a long exposure time of more than 08 hours. Later, the daguerreotype camera came along and cut the exposure period down to minutes. This breakthrough made it possible to record historical events and even portraits as we use today. Now, we can capture fleeting moments and share them with the world thanks to the instantaneous and accessible nature of modern photography.

How a human vision perceives the landscape

What are the Different Types of Cameras?

1. DSLR Cameras: These are great for taking clear pictures. They have removable lenses! DSLR stands for Digital Single-Lens Reflex, which lets you frame by looking through the lens. It's all thanks to a mirror and prism inside. Users love them for their manual controls, different lenses, & fantastic image quality.

DSLR (Digital Single-Lens Reflex) Camera

2. Mirrorless Cameras: These cameras are lighter & more stylish! They skip the big reflex mirror you see in DSLRs. With fancy interchangeable lenses and an electronic viewfinder, they show you what the camera will take before you snap the pic. This gives you a lot of creative options. You can use features like focus peaking or real-time effects—perfect for both beginners & pros!

Reference Image: Sony Mirrorless Camera

3. Point-and-shoot cameras: This little machine is all about being easy to use & portable. They have built-in flash and autofocus, so they take excellent photos quickly. This is the way to go if you want high-quality images without fussing with settings. They have a simple automatic mode & a fixed lens.

Reference Image: Kodak Pixpro Point and Shoot Camera

4. Smartphone Cameras: Phones today have some cool camera perks! They're super portable, thanks to their tiny size. Plus, computational photography helps fix low-light scenes and zoom issues. You can quickly share your photos too! Even though they don't have big sensors, they're perfect for snapping pictures on the go while getting excellent image quality.

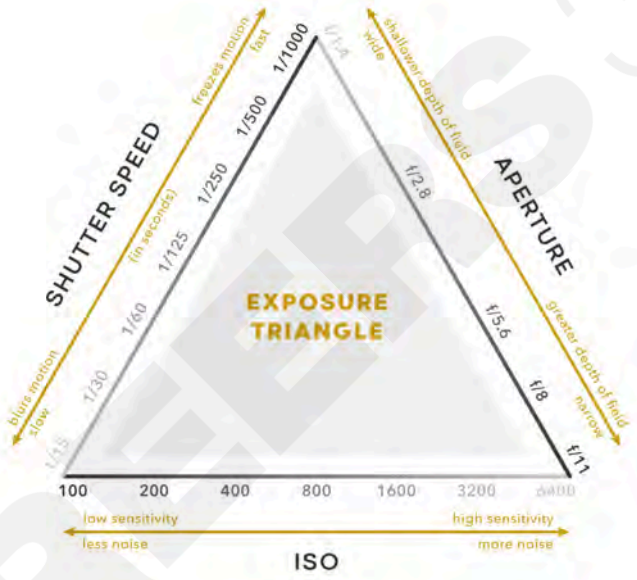
Reference Image: Google Pixel 2

Fundamentals of Photography

For Photography, we need to understand the exposure(**Controlling the light duration and intensity**). It controls the perceived lightness or darkness of a picture as your camera photographs it.

The three main factors that affect exposure are **as follows, combined and also known as the "Exposure** triangle." Mastering these components will enable you to manipulate your camera and provide the desired effect in your shots.

a. **Aperture**
b. **Shutter speed and**
c. **ISO**



a. <u>Aperture (F-Stop)</u>

The small opening from where light enters the camera is called the aperture.
It is measured in f-stops, such as f/2.8, f/4, f/8, or f/16 etc.

Wide Aperture (Small f-number, such as f/2.8): Provides a shallow depth of field by letting in more light. This is great for portraiture since it makes the subject stand out against a blurry background.

Narrow Aperture (High f-number, such as f/16): Increases depth of field by letting in less light. This makes the scene more sharply focused, making it ideal for landscape photography.

For instance, Let us understand the basics of Aperture from the image below.

f/2.8 (Wide Aperture)
Take note of how the blurry background isolates the subject.

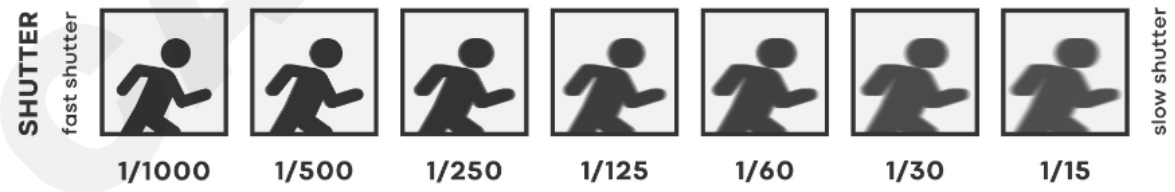
f/16 (Narrow Aperture)
Observe how the background and foreground are both sharply focused.

b. Shutter Speed

The duration of time for which the camera's sensor is exposed to light is called shutter speed. **It is measured in Seconds or fractions** of a second (such as 1/1000, 1/250, or 1/30).

Fast shutter speed (e.g., 1/1000): This stops motion and helps take pictures of subjects moving quickly, such as animals or sports.
Slow Shutter Speed (1/30, for example): Blurs motion, making it perfect for adding movement to pictures like light trails or waterfalls.

Let us understand through visual examples.



Fast Shutter (1/1000) captures and stops the motion of fast-moving objects/animals like birds in flight. Meanwhile, 1/30 is the slow shutter speed, which is useful in light arts that need to capture light for a longer duration.

c. ISO

ISO is referred to as the camera's sensitivity to light. A greater value of the ISO is required to capture the images at night or in low light, whereas a lower value between 100-400 is used to photograph in proper lighting conditions. The challenge is that the higher the value of the ISO, the more grainy and distorted the image becomes. In the auto mode, the camera adjusts the ISO automatically; however, in the manual mode, this needs to be optimised for perfect photographs.

Low ISO (100):
Clean image with minimal noise, taken in bright daylight.

High ISO (6400):
Noticeable noise in the image, taken in low-light conditions.

Camera Dial Symbols/Modes and Settings

A regular DSLR camera has many symbols imprinted over the dial, each with a specific purpose, as shown below. In previous NID and other design examinations, the meaning of some symbols(as depicted below) and their use have been asked directly.

For Example, What does Symbol-A mean **when the auto is already given on the dial?**
Here, A means Aperture Priority mode(A).

When using the **Aperture Priority mode, you can regulate the depth of focus** in instances when you want to: You set the aperture (f-stop) value, and the camera changes the shutter speed correspondingly to obtain the correct exposure.

1. **AUTO Mode**: The most of the new users utilise the auto mode of the camera to begin with the initial handling of the camera for enhancing the photography. The technique behind this is the light-meter reading, which works in milliseconds before the photograph is clicked and is so quick that the user may not even notice. This is how the camera selects the auto mode setting. A blinking green rectangle in some cameras is present in some machines to represent it through the viewfinder.

2. **Macro Mode:** This icon represents your macro capability, which you may use to extend the focus range of your camera and get up close and personal to catch minute details. It's perfect for photographing flowers, insects, and abstract subjects. However, after using your macro mode, don't forget to return to a different option to avoid delaying your concentration.

3. **Landscape Mode:** Most cameras include a unique setting for capturing the most significant aspects of a subject, which is ideal for landscape enthusiasts. With a wide depth of field, this option will automatically focus the camera on most of the scene.

4. **Night and Party Mode:** Both refer to the same feature: they are appropriate for use in low-light conditions. The camera must utilise slower shutter speeds in night mode since it knows there isn't much ambient (natural) light. To aid with exposure, it may trigger your flash automatically. As a result, you may get unexpected light trails and freeze-framed motion.

5. **Program Mode**: Although aperture and shutter speed are crucial for taking pictures, there are other settings on your camera that you should know about as well, and program mode will help you do so. You may adjust the ISO, exposure metering, and white balance while shooting by going into the program. Perfect for individuals who prefer to refine their work in the field and are a little bit more experienced.

P

6. **Manual Mode:** With manual mode, you hold the power. Regarding ISO, shutter speed, and aperture, the camera will step back and let you make all the selections. If you make a mistake in your settings, it won't assist you in balancing the exposure, but once you understand this feature, unique creative possibilities arise.

M

7. **Aperture Priority:** With aperture priority, you can select the aperture size while the ISO and shutter speed are automatically adjusted to get the best exposure. You can use it to learn about aperture without worrying about other settings, making it a great tool.

A/Av

APPLICATIONS OF PHOTOGRAPHY

Introduction:

In this part of Photography, we will explore the principles and their application in Photography. It takes a deep understanding of advanced photographic techniques to produce beautiful photographs. This article examines the importance of lighting, including artificial and natural lighting, and how it affects mood, tone, and clarity. It explores important technical concepts such as symmetry versus asymmetry, leading lines, figure and ground relationships, Golden Ratio, and Rule of Thirds. The study material also discusses the principles of image printing and image editing, ensuring that photographers are prepared to produce technically sound and aesthetically pleasing images.

ADVANCED PHOTOGRAPHY PRINCIPLES

01. Lighting Conditions

For a good composition and effect in an image in photography, the kind and quality of lighting are essential. Clarity, tone, and emotion are strongly impacted by artificial or natural light and its position with the subject. You can control a subject more skillfully by paying attention to how light plays with its angles and shadows. Hard light draws attention to angles and textures, whereas soft light softens facial characteristics. Acquiring natural and artificial lighting documentation skills is crucial for generating outstanding photos.

1a. Natural Light

"Natural Light" describes light originating from the sun or other natural sources. Depending on the time of day, the weather, and the location, it varies in strength, colour, and direction.

The most prevalent and potent natural light source is sunlight. When the sun is high in the sky, it can provide vivid colours and crisp shadows at sunrise and sunset, producing warm, fuzzy tones.

1b. Artificial Light

Artificial lighting in photography refers to using artificial light sources, such as LED panels, lamps, and flash units, to illuminate subjects. It provides control and consistency, which are necessary to keep lights consistent. Photographers can create desired moods and atmospheres by adjusting colour temperature and intensity.

Artificial Lighting gives the control over photography conditions like :

Control and Consistency: Offers consistent lighting settings for product and studio photography.
Changeable Colour Temperature and Intensity: This feature enables the development of neutral, cool, or warm tones to improve the mood and ambience of an image.
Shadow Management: Adjusts the severity or softness of shadows; for attractive portraiture, diffusers and softboxes are utilised.
Creative Lighting Effects: Provides striking effects that enhance depth and interest, such as backlighting and high-key setups.

2. Principles of Photography (Technical)

In photography, composition refers to deliberately placing visual components inside the frame. It entails 'assembling' these components to produce a unified and powerful picture. To get the ideal shot, every object in the scene must be carefully balanced and arranged. A good technical understanding of "Rules of Composition" can further enhance visual aesthetics.

2a. Rule of Thirds :

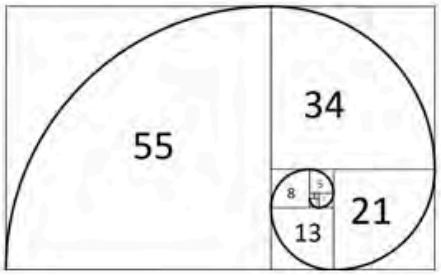
A basic compositional technique in photography, the rule of thirds divides a picture into nine equal portions using two horizontal and two vertical lines. Objects are positioned along these lines or their crossings to create balanced and dynamic photographs.

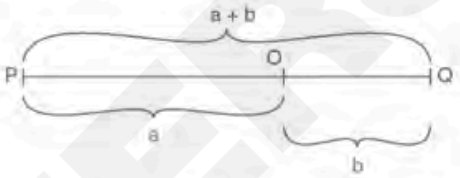
Composition mastery is a must for improving picture quality and producing genuinely striking shots.

2b. The Golden Ratio :

A mathematical ratio called the Golden Ratio, around 1.618:1, is frequently seen in nature and art. Arranging the subject at points that coincide with this ratio directs composition in photography and produces an organically beautiful and well-balanced picture. Achieving harmonious proportions through the Golden Ratio produces more visually appealing and captivating photos.

The Calculated value of the **Golden Ratio is 1.61803398875 (Phi)**

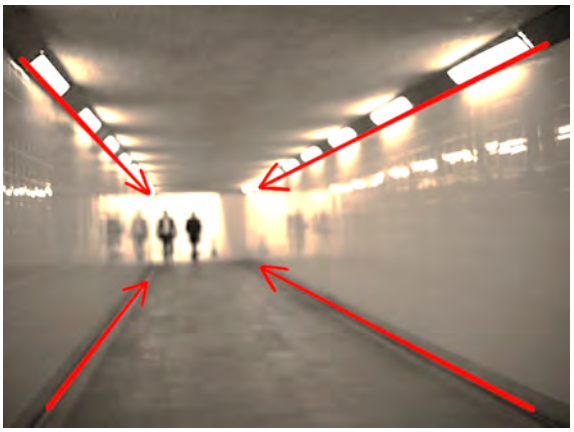




$$\frac{a}{b} = \frac{a+b}{a} = 1.618\ldots = \Phi$$

2c. Leading Lines :

In photography, leading lines are compositional elements that direct the viewer's attention through the picture, frequently in the direction of the main topic. Roads, rivers, fences, and architectural features are a few examples. For example, a picture of a trail snaking through a forest naturally directs the viewer's attention along the path, adding depth and emphasis. This method improves the photograph's narrative and visual flow.



2d. Figure and Ground :

In photography, the relationship between the subject (figure) and background (ground) is known as the "Figure to Ground" principle. To make the subject stand out, this approach highlights the contrast between the subject and its surroundings.

For instance**, it is easy to discern the tree (figure) from the sky (ground) when a dark silhouette of the tree is seen against a brilliantly light sunset sky.** This method draws attention to the main subject and increases visual interest.

2e. Symmetry & Asymmetry in Photography

In photography, symmetry and asymmetry are essential compositional elements. **A building reflected in water exemplifies how symmetry creates balanced images with mirrored parts on either side, suggesting harmony and stability.** Asymmetry adds vitality and visual appeal by contrasting and including off-centre features.

-Symmetry in Photography establishes a feeling of balance and order. For example, a striking composition can be achieved by placing the subject of a portrait on one side against a contrasting background.

Symmetrical Reflection of Bird in Water

- Asymmetry in photography: Assembling elements off-centre to produce a dynamic and visually appealing composition is called asymmetry.

For Example, Imagine a picture of a growing Mushroom with off-centre. This imbalanced appearance makes you tense and drawn to gaze about the frame. Asymmetry, unlike perfect symmetry, feels more organic and encourages people to linger over the image.

Image of a Mushroom, Asymmetrical Composition

Asymmetry adds movement and excitement, while symmetrical provides calm equilibrium. Both approaches are crucial for boosting photographic artistic expression and visual narrative.

-Radial Symmetry is the art of making a sense of symmetry using circular or radial patterns. A photograph with radial symmetry has a sense of harmony and order.

For Example: Picture a flower in full bloom, with petals equally dispersing from the centre. The central point draws Your eye inward, which becomes the focal point. This method is frequently employed in nature photography (spiral seashells, sunsets with star trails).

3. Basics of Image Editing

Overview

Photo editing is making changes to a photograph to enhance its appearance or produce a desired effect. It can include more intricate manipulations like compositing and retouching and more straightforward alterations like cropping and straightening etc.

Must Know Techniques and Tools for Editing

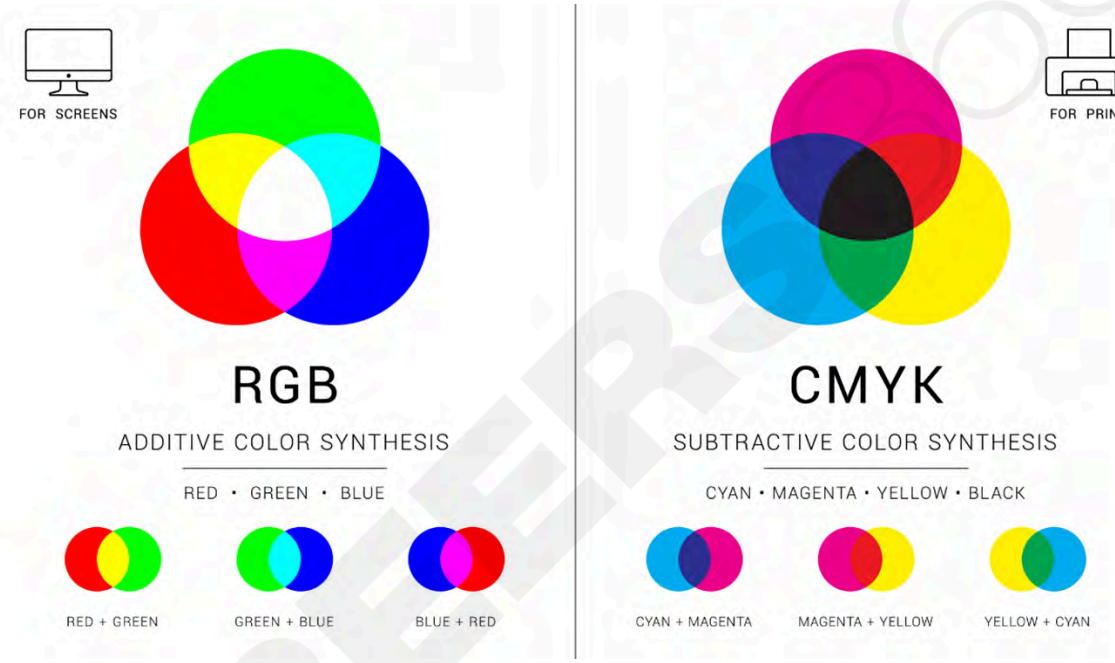
a. **Cropping**: Removing an image's undesired exterior regions to enhance focus, composition, or frame.
b. **Straightening**: Orienting the picture to make up for skewed or slanted components.
c. **Exposure Adjustment**: Adjusting the image's brightness to make sure it is neither overexposed (overexposed) nor too dark (underexposed) is known as exposure adjustment.
d. **Contrast**: To create depth and detail, increase the difference between the image's lightest and darkest areas.
e. **White Balance** is the process of adjusting the colours to compensate for the light source's colour temperature and make the image appear more natural.

f. **Saturation and Vibrance** : Increasing or decreasing the intensity of colours in an image is known as saturation and vibrancy.

g. **Noise Reduction**: Noise reduction lessens an image's graininess or speckles, frequently brought on by dim lighting.

4. Fundamentals of Image Printing

4a. RGB Vs. CMYK Color Model:



Credits : Image Source (https://globalcomix.com)

RGB Model

The additive RGB (Red, Green, Blue) colour model is utilised in electronic and digital displays. It combines different intensities of red, green, and blue light to create colors. White light is created when the intensity of all three colours is maximised. RGB is perfect for colourful digital images because of its wide color gamut. It is frequently employed in digital photography, web design, and other media that use light-based displays.

CMYK Model

CMYK (Cyan, Magenta, Yellow, Key/Black) is a subtractive colour model utilised in colour printing. It produces colours by removing light with cyan, magenta, yellow, and black inks.

When mixed, these inks absorb light at different wavelengths to create a variety of hues, with black being made by all four. With a narrower colour spectrum than RGB, CMYK is better suited for printing on tangible materials like paper. Producing printed items like brochures, posters, and packaging uses the CMYK model for optimised results.

Below is a table that compares the RGB vs CMYK Printing Theory.

Aspect	RGB	CMYK
Full Form	Red, Green, Blue	Cyan, Magenta, Yellow, Key (Black)
Color Model Type	Additive	Subtractive
Primary Colors	Red, Green, Blue	Cyan, Magenta, Yellow, Black
Color Creation	Colors created by adding light	Colors created by subtracting light
Color Formation	Combining red, green, and blue light	Combining cyan, magenta, yellow, and black inks

BRAIN TWISTER EXERCISE

Question: Using the last three photos in your phone, create a composite image conveying a story. Explain your creative approach, the story you want to tell, how you selected the photos and the methods you used to make them mix smoothly.

COLOR THEORY

(Color Wheel, Primary Secondary & Tertiary Colors)

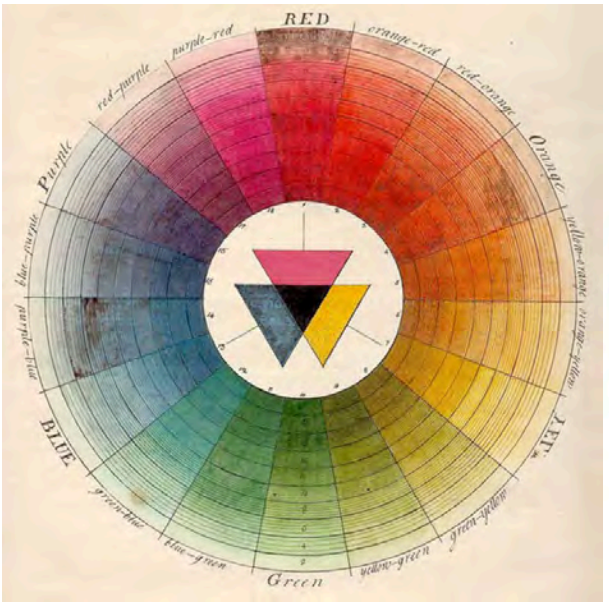
What is Color Theory?

Colour theory is the study of how colours interact, influence each other, and affect human perception. It encompasses the principles of color mixing and the visual effects of specific color combinations. Artists and designers use colour theory to create aesthetically pleasing and harmonious works. Understanding color theory is essential for effectively conveying emotions and messages through visual media.

Color theories create a logical structure for color. For example, if we have an assortment of day-to-day things we see around, we can organise them by color and place them on a circle that shows the colours in relation to each other.

Colour Wheel

The colour wheel is a round diagram that shows how different colours are related. It has primary, secondary, & tertiary colours set out in a clear order. Artists & designers rely on this tool to grasp colour harmonies and make balanced designs. It's a key part of colour theory for visualising how colours work together.



1666, Isaac Newton

Modern Colour Wheel

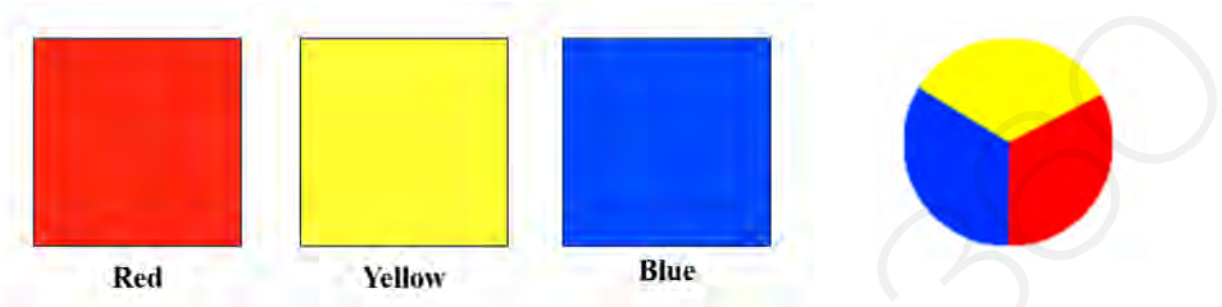
Sir Isaac Newton created the first colour wheel back in 1666. He mapped colours in a circle to highlight the links between primary, secondary, & tertiary hues. Newton's work formed the base for colour theory, showing the visible light spectrum.

Understanding the Color Wheel

A color wheel typically has 12 colors. It includes primary, secondary, & tertiary colors.

Primary Colors

These simple colors. You can't mix other colors to make them. On the traditional color wheel, the primary colors are red, yellow, & blue.

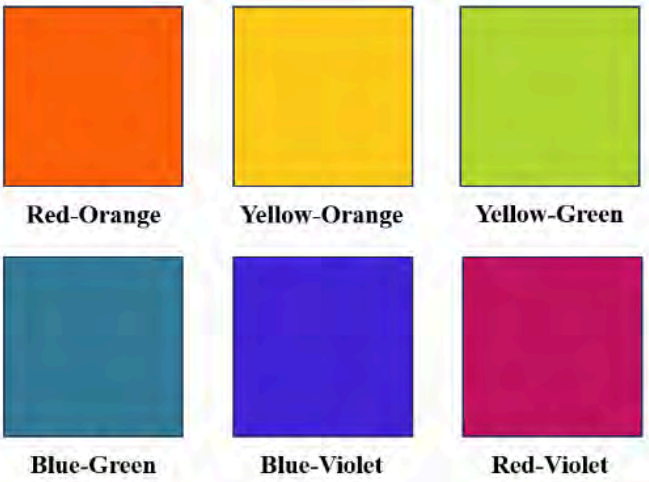


Secondary Colors

When you mix two primary colors, you get secondary colors. They are orange, green, & purple.

Tertiary Colors

These result when you mix a primary color with a secondary color that's next to it on the wheel. For example, mixing red & orange gives you red-orange.



Warm Colors
Colors like red, orange, and yellow, which evoke warmth and energy.

Cool Colors
Colors like blue, green, and purple, which evoke calm and relaxation.

Color Harmonies

Color harmonies refer to combinations of colors that look good together.

Analogous Colors: These are colors that sit next to each other on the color wheel. They usually match nicely and create calm & cozy designs.

Example:
1.ORANGE+YELLOW-ORANGE+YELLOW
2.BLUE+BLUE-VIOLET+VIOLET
3.GREEN+BLUE-GREEN+BLUE

Complementary Colors: Opposite colors on the wheel create a strong contrast. When combined, they give a bright & lively look.

Example:
1.RED-VIOLET+YELLOW-GREEN
2.BLUE+ORANGE
3.YELLOW+VIOLET

Triadic Colors: This scheme consists of three colors spaced evenly around the wheel. They're often bright and work well together.

Example:
1.RED+YELLOW+BLUE
2.ORANGE+GREEN+VIOLET
3.RED-VIOLET+BLUE-GREEN+
YELLOW-ORANGE

Split-Complementary Colors: This one uses a base color plus two colors next to its opposite on the wheel. It gives strong contrast but feels less tense than straight complementary colors.

Example:
1.RED-ORANGE+BLUE+GREEN
2.YELLOW+RED-VIOLET+BLUE-VIOLET
3.BLUE-VIOLET+ORANGE+YELLOW

Tetradic Colors: Here, you have two pairs of complementary colors. This creates lots of options for colorful designs!

Example:
1.RED-VIOLET+ORANGE+
YELLOW-GREEN+BLUE
2.VIOLET+RED-ORANGE+
YELLOW+BLUE-GREEN

Colour Properties

- **Hue:** This is the name of a color, like or blue. It's the purest version of a color without mixing white or black.
- **Tint:** When you add white to a color, you create a tint. This makes the color lighter.
- **Tone:** A tone is made by mixing grey into a color. This softens how strong it looks.
- **Shade:** You get a shade by adding black to a color. This darkens it.
- **Saturation:** This shows how intense or pure the color is. High saturation? The color looks bright & vivid. Low saturation? It’s more muted or dull.
- **Value: This refers to how light or dark a color is. If you mix white with a color, that’s a tint. Adding black creates a shade.**

Color Psychology

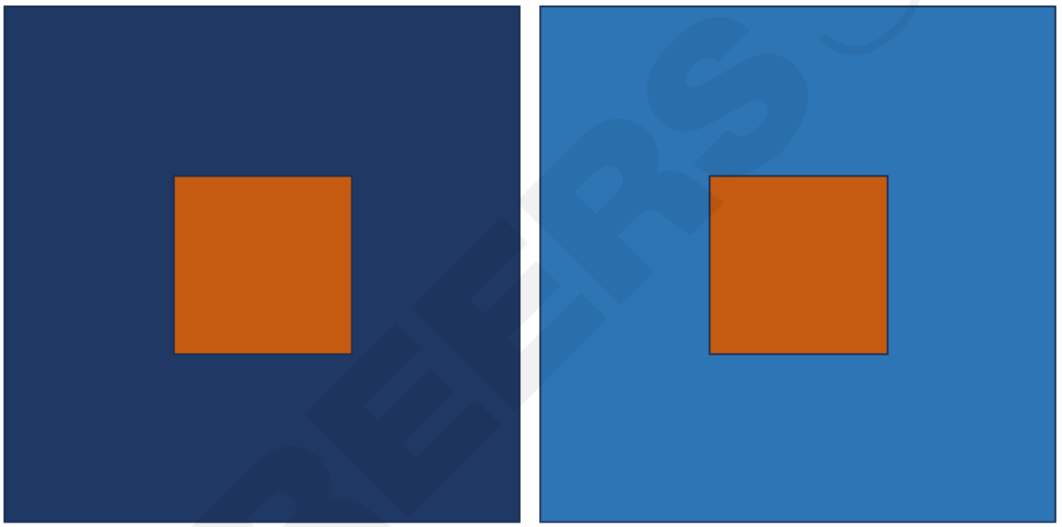
Color psychology is the study of how human emotions, behaviour, and perceptions are influenced by colors; certain hues frequently elicit particular psychological reactions.

Design decisions in a variety of industries are influenced by color psychology, which explores how colors affect human behaviour and emotions. It takes into account how individual variances and cultural influences impact color perception as well as the practicality of color use in various settings.

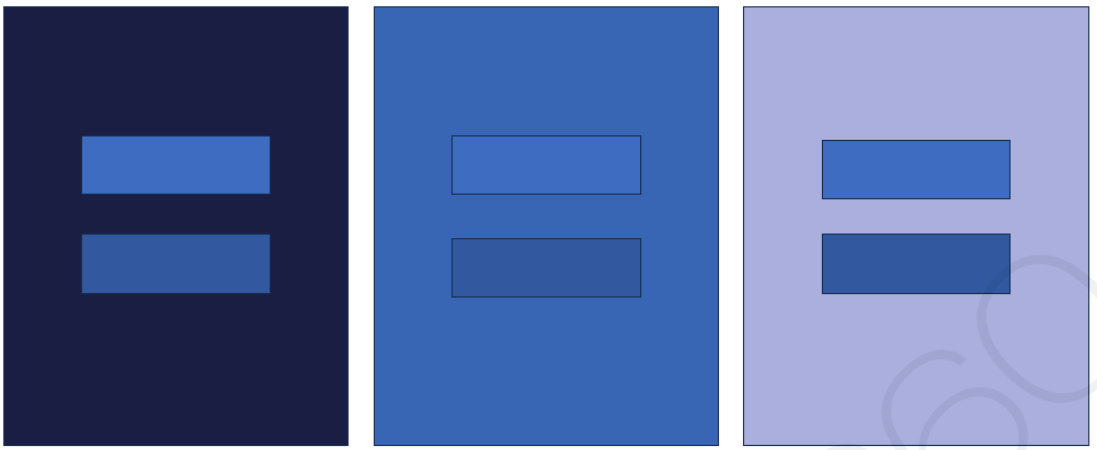
Color Interaction

The term "color interaction" describes how distinct hues interact with one another to alter perception of color and produce a variety of optical effects, including vibrancy, contrast, and harmony.

- Darker surrounding color –the central square appears lighter
  Lighter surrounding color –the central square appears darker

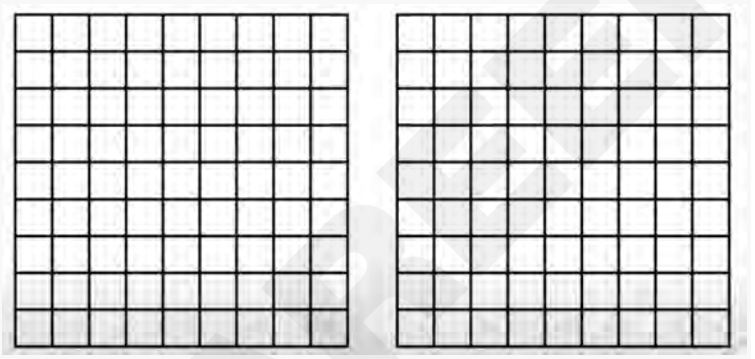


- The perceived difference between two colors appears more distinct when they are surrounded by a third color.



Sample Questions:

Q. Fill the grid with colors according to the following themes.



Theme 01: Dawn Theme 02: Extrovert

*Hint - To solve this type of question first breakdown the meaning of Theme into keywords and then picking the colour according to how they feel and express it.

Q. Look for a comparable combination on the colour wheel using options (NID DAT 2024)

A. Yellow-Orange/Yellow/Yellow-Green
B. Red-Orange/Red/Magenta
C. Purple/Blue/Green
D. Yellow/Cyan/Orange

Spatial Ability: Block Counting

Introduction

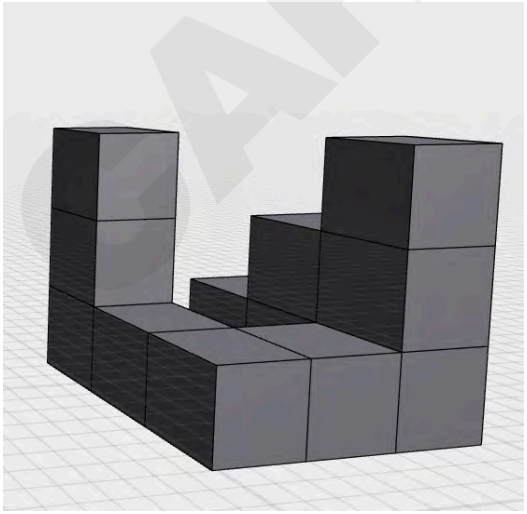
The NID-DAT exam evaluates your spatial and visual ability. Block counting is a critical exercise that improves these skills, enabling you to see and work with three-dimensional structures. This study guide will help you comprehend and become an expert at block counting so you'll be ready for this section of the test.

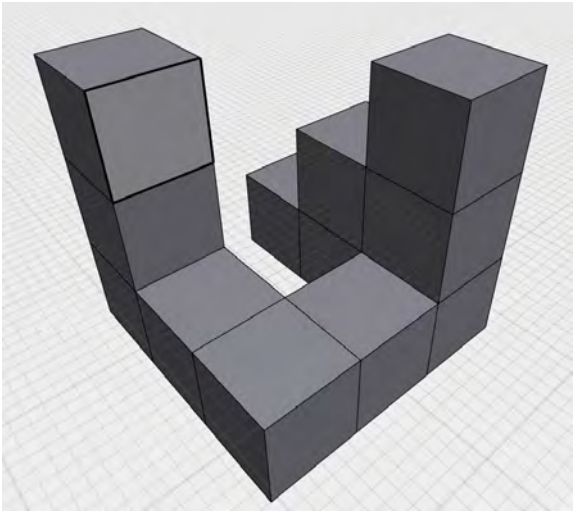
The questions are asked to count visible and hidden cubes/blocks, which need strong visualisation skills in an aspirant. The Exercise is designed to cultivate the skills of aspirants from simple to advanced level.

Block counting is figuring out how many distinct blocks—whether basic or complex—are present in a particular arrangement.

A simple question in this section could be something like this.

Q1: Considering the given cubes of the same size and dimensions(two different views of the same arrangement), count the number of cubes in the given arrangement without any repetition.





Options:

A= 9 B= 10 C= 11 D=12

Techniques and Challenges for Block Counting

Layer-to-Layer Method

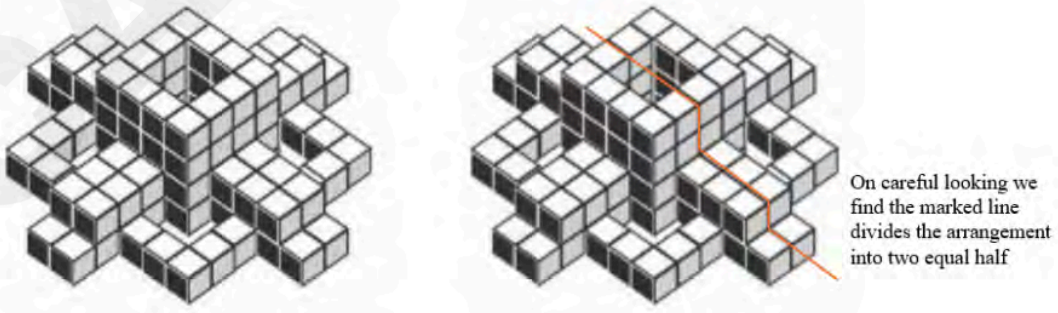
- **Step 01**: Break down Complex structures into individual layers.
- **Step 02**: Counting the blocks in each layer separately to later sum them all.
- **Step 03**: Identify if there are any hidden blocks or no blocks in the given space.

Symmetry vs Asymmetrical Arrangement of Blocks

The block arrangement provided usually follows a Symmetrical and Asymmetrical arrangement.

a. Symmetrical Arrangement

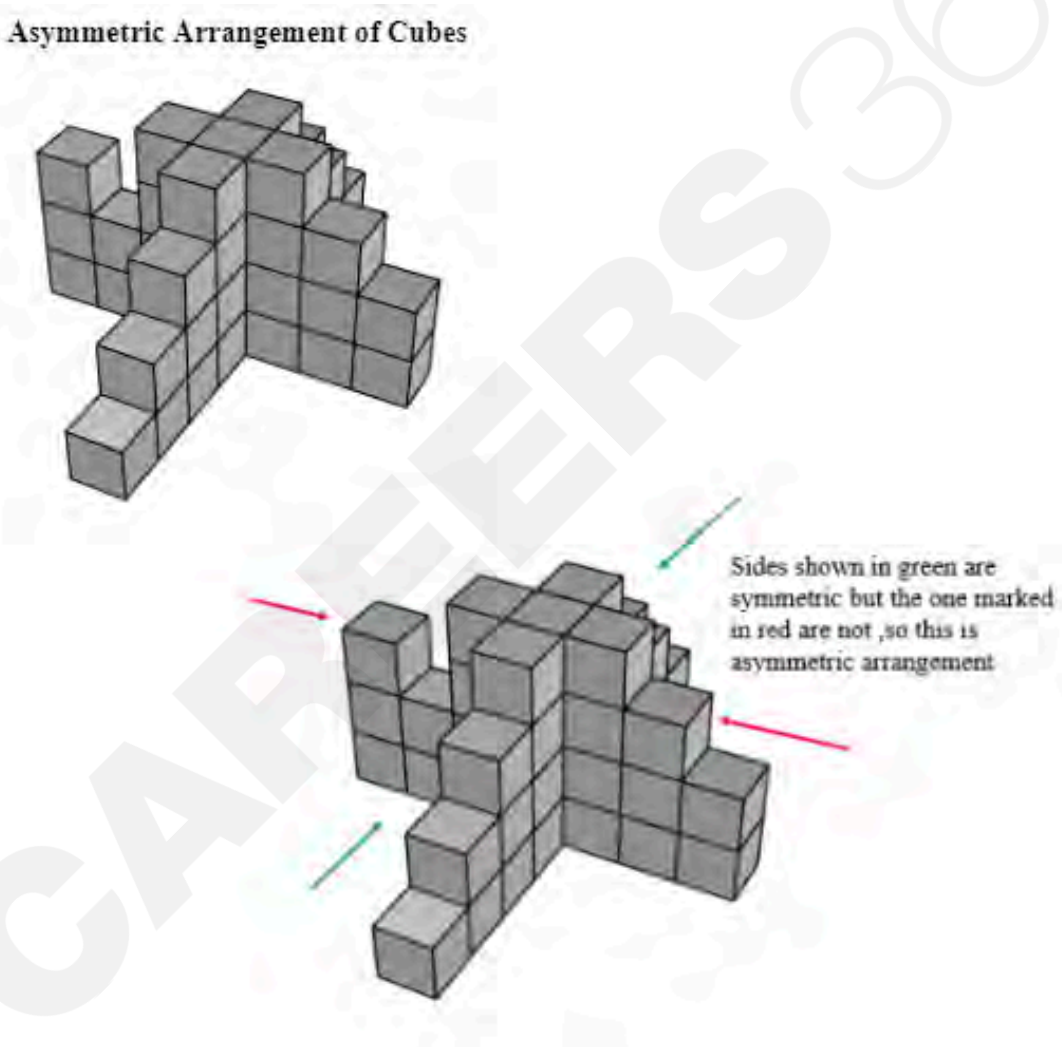
In block counting, symmetry describes a proportionate and balanced arrangement of blocks. One side of a symmetrical building is the mirror image of the other, and the other half is identical. Because you only need to count the blocks in half and then double the count to get the total number of blocks, this attribute makes the counting fast.



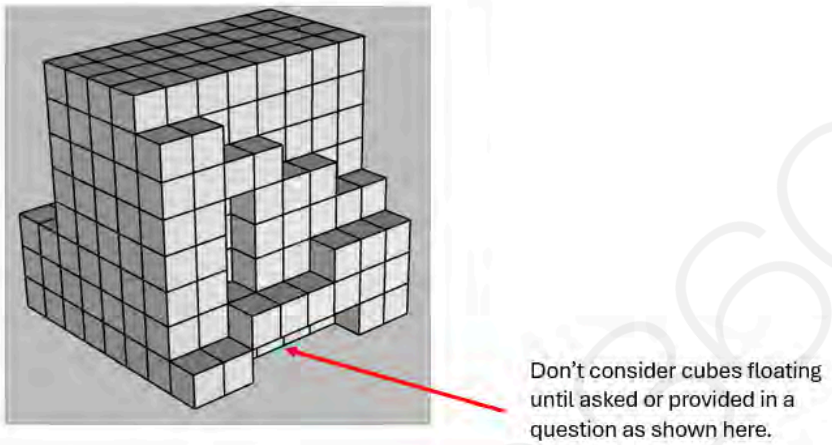
Next, we can count the number of cubes in either direction, either left or right of the arrangement, and multiply by two(2) to calculate the total number of cubes quickly.

b. Asymmetric Block Counting

Conversely, an imbalance or lack of proportion in the block arrangement is called asymmetry. Counting becomes more difficult since the two halves of an asymmetrical building are not identical. Each structure component must be looked at separately to determine the number of blocks in the given arrangement.

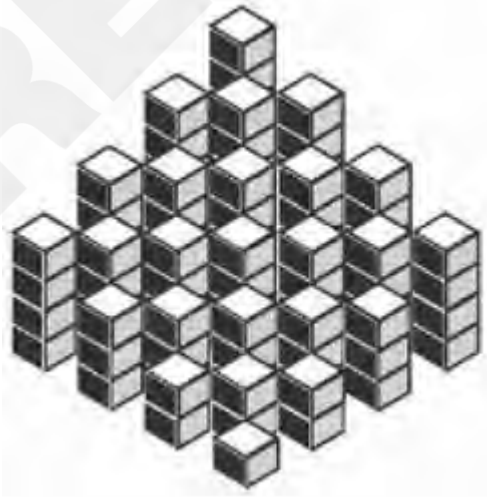


Tips & Tricks Worth Remembering

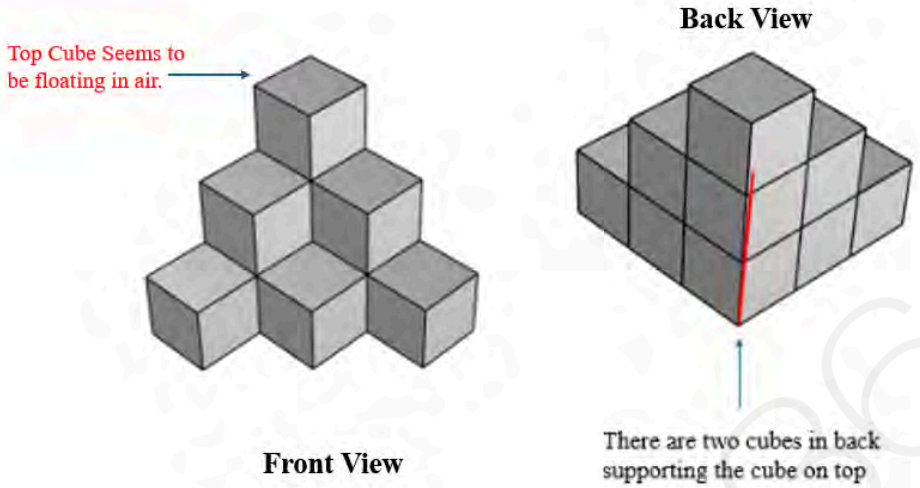


- Most aspirants were found attempting the question confidently, later to realise that they had overlooked the hidden blocks in the question image upon rechecking.

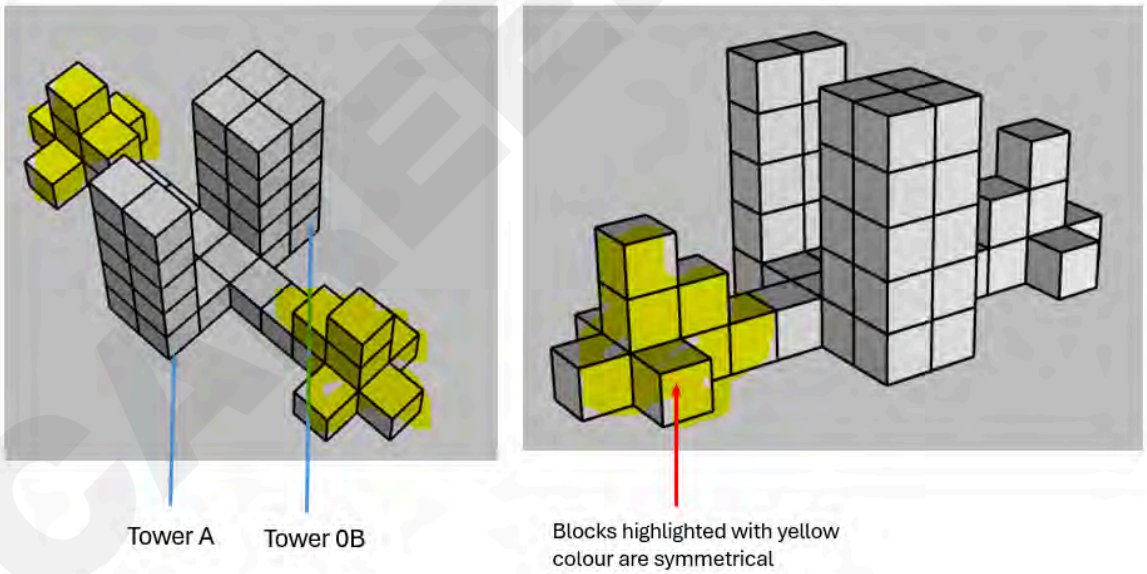
- Due to the Perspective View of the image, Miscounting is also a standard error that needs training and practice to overcome and crack the NID-DAT Exam.



- Whenever there is a cube in the air, it is evident that there is support below; thus, always consider the support below that cube as another or a set of cubes per the 3D visual image shared.



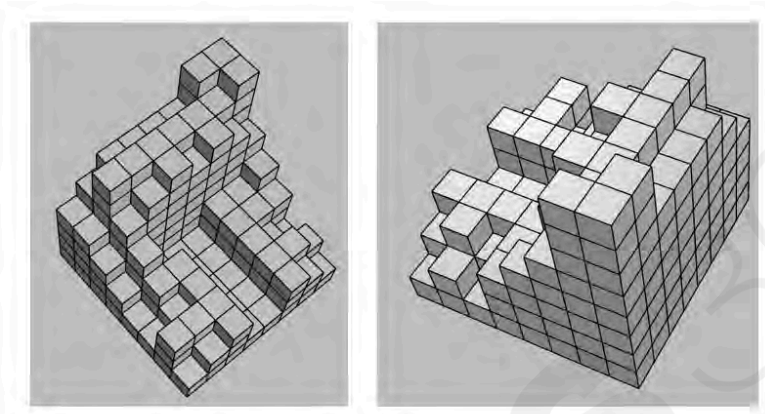
- For complex cubes, divide the arrangement into two or more fragments for easy visualisation and counting.



For example, in the above example, to count the cubes of the arrangement, first check if there is any asymmetry possible. Later, the arrangement is divided into Tower-A & Tower-B, including the non-common cubes between the towers.

Practise Question for NID/UCEED/CEED DAT Examination

Q1: For the given two views of the same arrangement of cubes, count the number of cubes.



Hint: Try to find a line that divides the arrangement and break it down into two parts for counting

Q2: For the given arrangement of cubes, count the number of cubes.

Art Movements

In this article, we will be covering the different art movements that hold significance to NID-DAT examinations and other DAT examinations conducted by various institutions, both public and private. This section has frequently been asked under the general awareness section of the examination.

The Art Movements here are classified as Indian Art Movement and Western Art movements asked frequently.

Major Indian Art Movements

1. Indian Bengal School of Art

At the beginning of the 20th century, the Bengal School of Painting was born out of contrast to Western academic painting styles. The famous painter Abanindranath Tagore was heading this movement to bring back Indian creative traditions and focus on the Indian themes and methodologies for making natural pigments and mythological subjects. The movement played an important role in India's campaign to create as sense of National identity.

Abanindranath Tagore's
"Bharat Mata"

2. The Baroda Group

The Baroda Group was founded in the 1950s at the Baroda famous Maharaja Sayajirao University, close to Indian traditions and reality and socially attached to Indian societies. By adopting modernist techniques, renowned artists such as Bhupen Khakhar and K.G. Subramanyan depicted contemporary subjects and helped to overcome the gap between Global modernism and Traditional Indian Art Styles.

Bhupen Khakhar's **"You Can't Please All"**

3. Indian Madhubani Art

Mithila celebrates the traditional art of Madhubani, which originated in Bihar. It differentiates itself by its intricate patterns and vivid use of colours. Its distinguishing style depicts a sense of cultural legacy and nature, imbibed in mythology from the stories of everyday life. It is practised by women on the walls and floors during the festivals.

4. Indian Tanjore Painting

Tanjore paintings originated from the southern part of India i.e. Tamil Nadu and are known for their vibrant colours, rich surface creation, and compact composition styles. This is the celebrated South Indian Art Form, which typically utilised motifs inspired by Hindu gods and goddesses, blending the devotion in the art form to represent the cultural and religious heritage by using materials like gold foils to create a perception of 3-dimension.

5. Indian Progressive Artists' Group

The Progressive Artists' Group in Bombay started in 1947. They showed what made India after gaining independence. Artists like F.N. Souza and M.F. Husain used modern techniques. They mixed local themes with styles from around the world. Thanks to their efforts, due to them contemporary Indian art started flourishing.

F. N. Souza, **Goan Peasants**

Important Western Art Movements

1. Greek Art Movement

Greeks' art bloomed between the 8th and 1st century B.C. Paid much attention to beauty, balance, & natural looks; It had a great impact on the western art. Due to this civilising process and vst context, this movement embraced human body and mythology in sculptures, pottery and buildings.

The Parthenon : Greek Structures

2. Roman Art Movement

From about the 1st century BCE to the 4th century CE, Roman art showed realism and usefulness. The mighty Roman Empire used sculptures, mosaics, & large buildings to show off its power. They borrowed many ideas from Greek art too.

The Colosseum : Rome

3. Egyptian Art Movement

Egyptian art existed for more than three thousand years! It was characterised by rather singular & symbolic elements. It was preoccupied with afterlife a lot of the time. Great pyramid and elaborated paintings of tombs were characteristic features of this epoch. Statues underlined such notions as order, stability, deities, etc. The Great Sphinx of Giza is a perfect example of this movement, which reconstructs the past with few of the original features of Egyptian sculpture.

The Great Sphinx of Giza

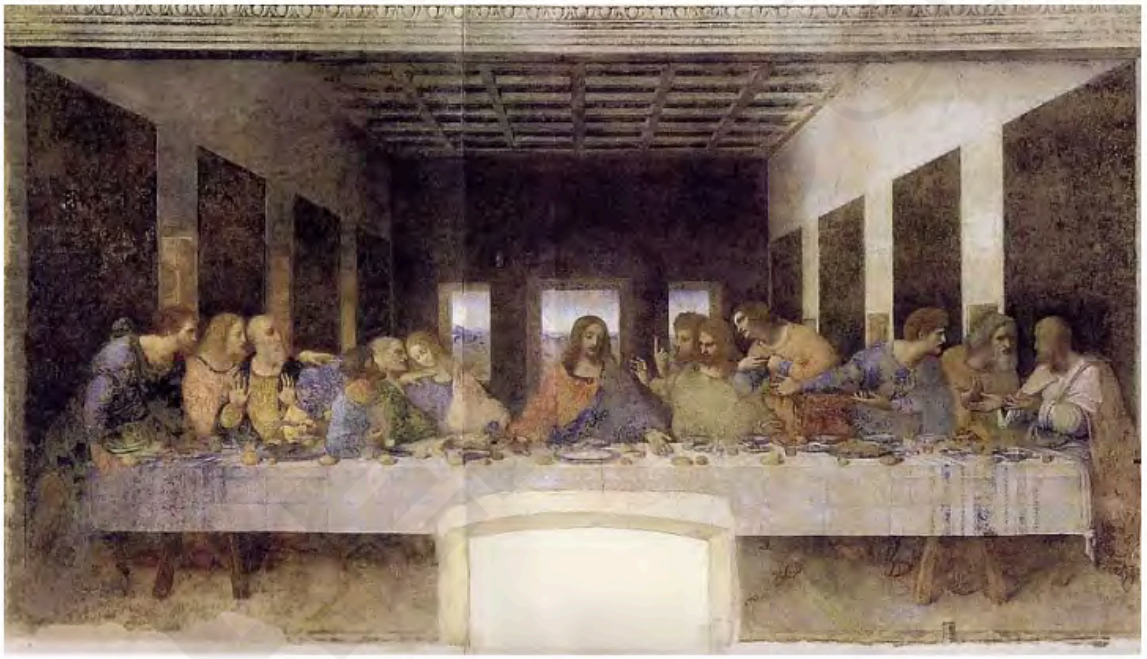
4. Gothic architecture

Gothic architecture popped up in the 12th century. It's easily recognised by tall arches, flying buttresses, & ribbed vaults. The goal was to create awe and bring people closer to God through light & height—just look at those beautiful cathedrals with their colourful stained glass!

Gothic artwork Architecture in Notre-Dame Cathedral

5. Italian Renaissance Art

The Italian Renaissance happened between the 14th and 17th centuries. This period brought back humanistic ideas and techniques from classical times. Artists created fantastic works in painting, sculpture, & building that celebrated human skills & our world.



Leonardo da Vinci's **"The Last Supper"**

6. 18th Century Art

In the 18th century, Neoclassicism emerged, focusing on ancient architecture's grand yet simple styles. Rococo also became popular during this time with intricate decorations and playful designs! These movements reflected both reason and escapism that were present in society.

Jean-Honoré Fragonard's **"The Swing"**

7. Cubism

Cubism began in the early 20th century! This new style changed visual art completely by showing objects from multiple perspectives—at once! It broke away from traditional views by highlighting geometric shapes & abstract designs.

Pablo Picasso's **"Les Demoiselles d'Avignon"**

8. Abstract Expressionism,

In the period of the 40s and the 50s Abstract Expressionism dominated the American art scene. This movement made artists paint feelings in creation—usually, raw and free; some artists used bright colours and vigorous compositions to depict the spirit and novelty

Jackson Pollock: **“Autumn Rhythm” (1950) and “Number 1A, 1948”**

9. Surrealism in Art

Surrealism started in the early 20s and deals with the creative aspect of our subconscious minds! Some artists painted dreamlike objects which blur the actual reality by juxtaposing unrelated things. The style in question has affected visual artistry, literature and film in the international arena.

Salvador Dalí’s **"The Persistence of Memory"**

10. Neoclassicism

The Oath of the Horatii by Jacques-Louis David, 1784,

Neoclassical style emerged when Italy uncovered the city of Pompeii in the eighteenth century. This referred to art revival that was centred on paintings and sculptures pertaining to the Greek and Roman mythology which replicated temple designs, thus reintroducing classicism.

Conclusion

For the aspirant who is willing to perform in the DAT exams, it is important to understand that the awareness of these art movements assists one to think critically about how the artistic skills developed through the social cultures. It enables the student to understand more about the power stories of Art movements that revolutionised the whole concept of contemporary art and its forms

Walk and Run Cycle

Introduction

Design aptitude tests like the NID DAT (National Institute of Design) and UCEEDUndergraduate Common Entrance Examination for Design) often focus on questions about animation and movement cycles. These can include things like walk and run cycles. They check how well you grasp human anatomy and movement, plus how you illustrate these ideas clearly.

Here, let's tackle one important topic that often comes up in the NIDAT Exam.

1. **Human:** Walk, Run & Jump Cycles
2. **Animal**: Walk Cycles
3. **Birds:** Flight Cycles

Understanding Walk and Run Cycles

1a. Walk Cycle

A walk cycle shows a series of frames or drawings that illustrate a character taking steps over and over again, which makes it look like they're walking. Usually, a walk cycle has four main phases: contact, recoil, passing, and high point.

Contact Recoil Passing High Point

Here's a helpful way to remember the walk cycle: C_R_P_H

Step 01 (Contact): heel of the front foot hits the ground.

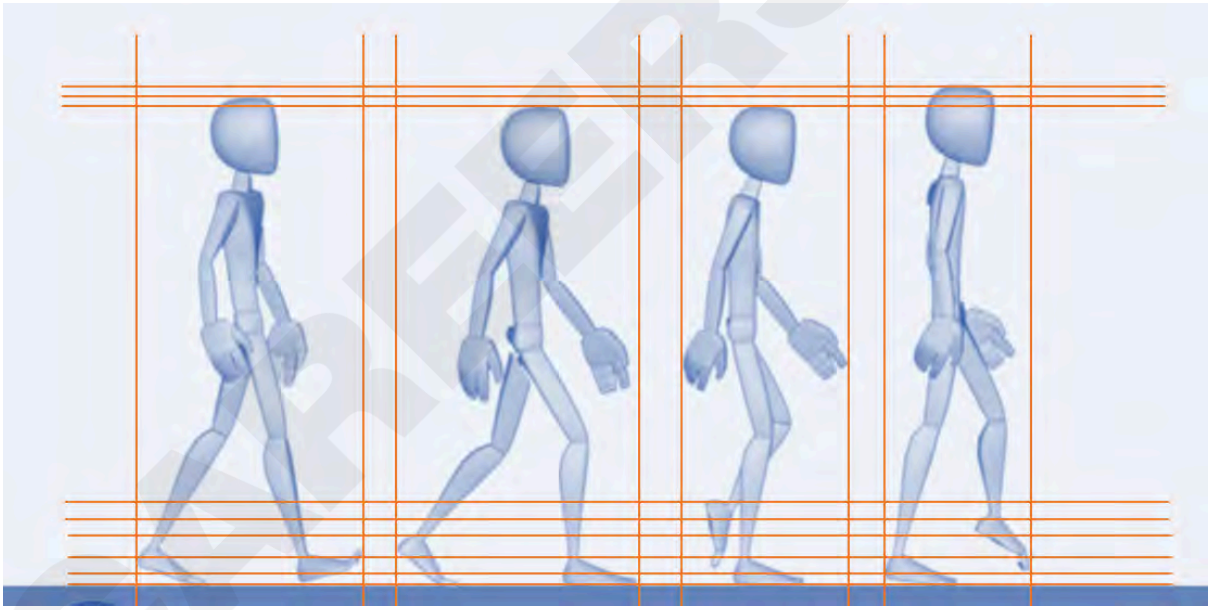
Step 02 (Recoil): While the back foot is flat, the front foot is just about to pass it.

Step 03 (Passing): The front foot moves ahead. The back foot starts lifting off the ground.

Step 04 (High Point): At this point, the body is at its tallest. The back foot is off the ground, while the front foot fully touches down.

Usually, a regular walk cycle has eight frames. These four steps repeat back & forth with both legs.

How it works,



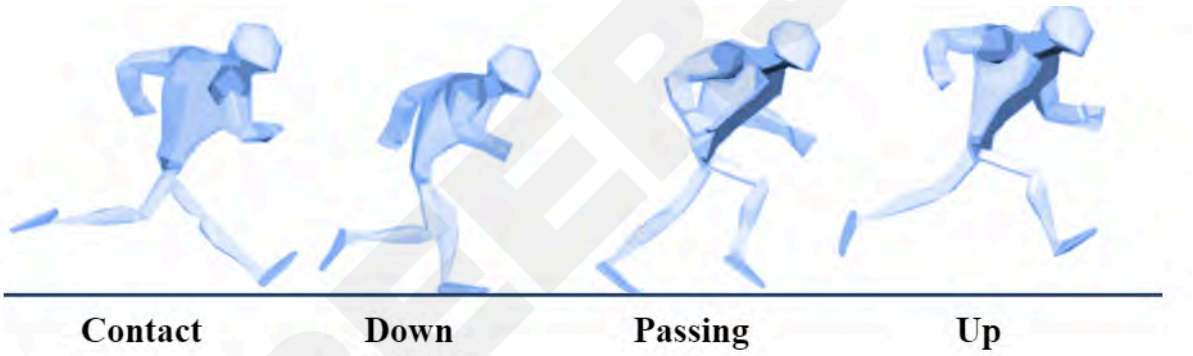
Some lines are made to confine it. If you notice properly you can see that Head of the person gets low and high in every other step with respect to leg movement. To acknowledge it better, a simple trick is to know that if both your feet are on ground you are at normal height but it starts to vary as soon as you lift your leg up and how much you spread it forward.

Characteristics to identify:

- The body rises and falls slightly with each step.
- Arms swing opposite to the legs (right arm forward when the left leg is forward, and vice versa).
- The head moves slightly up and down.

1b . Run Cycle

A run cycle is a sequence of frames or illustrations that depict a character running, creating the illusion of fast-paced movement. The run cycle includes more pronounced movements and has phases like contact, down, passing, and up.



1. **Contact:** The leading foot makes contact with the ground**.**
2. **Down:** The body lowers as the leading foot absorbs the impact.
3. **Passing:** The trailing foot passes the leading foot, and the body starts to lift.
4. **Up:** The body reaches its highest point with both feet off the ground (flight phase).

The principle of understanding the run cycle is the same as the walk cycle but there are few things to keep in mind like, the more you start increasing the speed your legs lifted up because it just touches and the legs are spread widely to cover more area and it starts from lower to higher in a motion.

***A run cycle typically requires fewer frames than a walk cycle due to the faster pace, often four to six frames and sequence could be remembered as C_D_P_U.**

Characteristics to identify:

- Movements are more exaggerated and dynamic compared to a walk cycle.
- The body leans forward to show momentum.

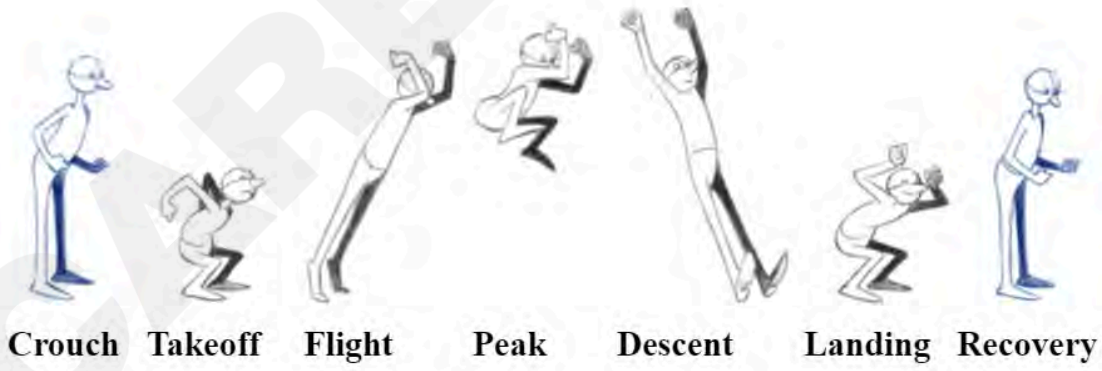
- The flight phase shows the character completely off the ground.
- Arms swing more vigorously to balance the faster leg movements.

Differences Between Walk and Run Cycles

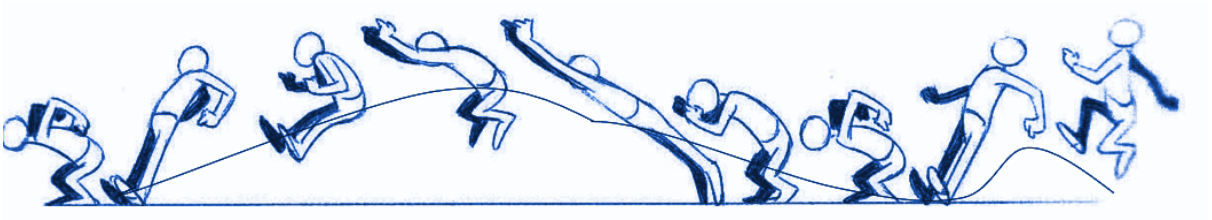
	Walk Cycle	Run Cycle
Pace	Slower, more deliberate movements.	Faster, more dynamic movements.
Body Movement	The body rises and falls slightly with a gentle sway.	The body leans forward, with a pronounced rise and fall.
Foot Contact	One foot is always in contact with the ground.	There is a flight phase where both feet are off the ground.
Arm Swing	Gentle, opposite swing to the legs.	More vigorous and exaggerated swing to balance the fast movement.

1c. Jump Cycles

Picture a child trying to jump high grab some mangoes from a tree If we look at this in slow motion we can see the action. A jump cycle is a series of frames showing a character or animal as they jump—from crouch to landing.



How does a person jump?



In the above, you can see how someone jumps. First, it's like running. You push down on the ground hard, which flings you up and forward into the air. As you reach the top of your jump, gravity pulls you back down. When you land, your body adjusts to keep you balanced so you don't fall.

There are seven steps to perform a jump:

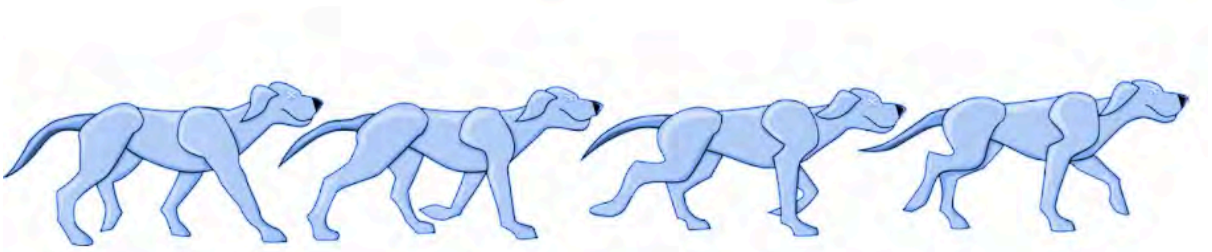
1. **Crouch:** The character bends their knees, getting low to store energy for the jump.
2. **Takeoff:** They push off the ground with their legs and shoot up.
3. **Flight:** They're in the air, usually reaching their highest point.
4. **Peak:** This is the top of the jump, where they stretch out fully.
5. **Descent:** They start to come down, often tucking in a bit to get ready for landing.
6. **Landing:** They hit the ground and bend their knees to lessen the impact.
7. **Recovery:** They go back to standing tall, ready to move again.

What should we look for?

- **Smooth Transitions:** Each part should blend nicely into the next one.
- **Weight Shift:** The way a character's weight moves helps show their balance while jumping.
- **Exaggeration:** Making movements a bit bigger can help highlight the energy & dynamics of jumping.

Animal Walk Cycle

A walk cycle in animals is a sequence of frames that depict an animal taking steps in a repetitive loop, creating the illusion of walking. The specifics of the walk cycle can vary greatly between different types of animals. All the Phases: Contact, Recoil, Passing and High Point are same as human, but there are few things to keep in mind, which makes it different.



Steps in Animal Walk Cycle

- **Phases:** Walk cycle often includes a sequence where one foot is lifted, another is placed on the ground, and the remaining two provide support.
- **Leg Movement:** Diagonal pairs of legs move in sync (left front and right hind leg move together).

Flight cycle for bird typically involves 05 steps

- **Body Movement:** The body moves up and down slightly, with a gentle sway from side to side.

3. Flight of Birds 

A flight cycle is a sequence of frames depicting a bird's wing movements during flight, from the downstroke to the upstroke.

Steps Involved in Flight Cycle

1. **Downstroke:** The wings move downward and forward, generating lift and propulsion.
2. **Bottom of Downstroke:** The wings reach the lowest point in the stroke.
3. **Upstroke:** The wings move upward and backward, reducing resistance and preparing for the next downstroke.
4. **Top of Upstroke:** The wings reach the highest point in the stroke.
5. **Glide (optional):** Some birds have a gliding phase where the wings are extended and relatively motionless, allowing the bird to coast.

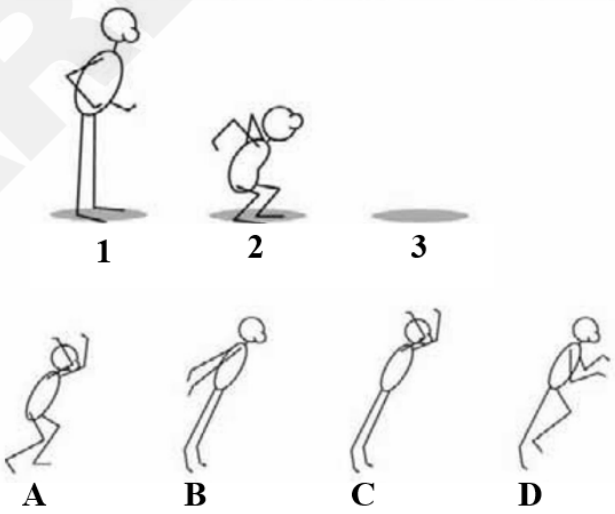
To understand in a simple way, suppose you have a hand fan the way you move it left or right to get air, which means you are directing it towards yourself, similarly a bird moves its wings up and down where it is trying to push air downwards and move forward.

Characteristics to identify:

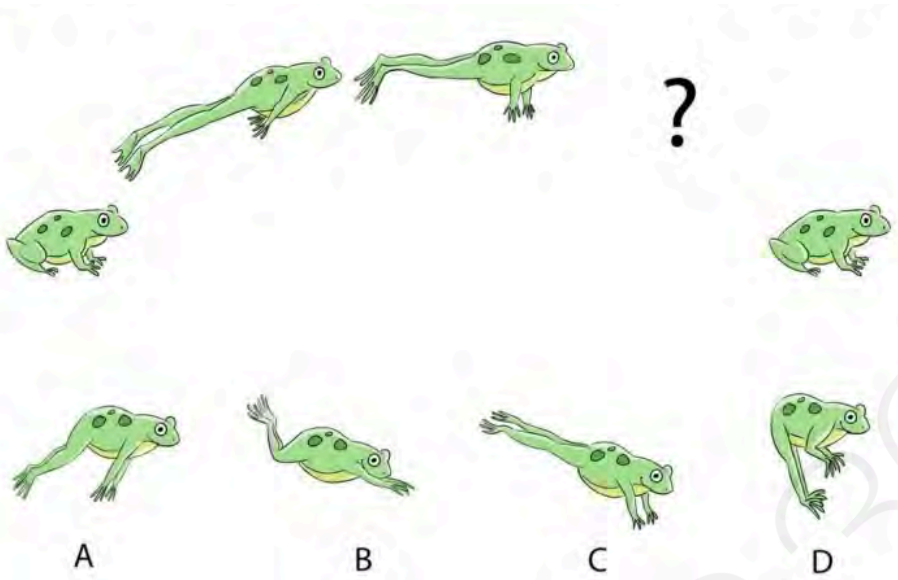
- **Wing Flexibility**: Showing the bending and flexing of the wings, particularly at the joints.
- **Feather Movement**: Illustrating how feathers may spread or overlap during different phases of the wing stroke.
- **Body Movement**: Demonstrating how the bird's body might rise and fall slightly with each wing beat, and how the tail feathers aid in steering and balance.

Sample Questions:

Q-01. What will be the most probable pose at position 3, to complete the sequence below?



Q 02. Which option will replace the question mark as the frog jumps in an animation sequence?



FAQ's based on Topic

1. Why is it important to know run, jump and walk cycle to achieve the NID-DAT exam?

- Provides a check on how well one comprehends ideas pertaining to movement, body structure as well as animation.
- the first example demonstrates the ability of a robot to observe and emulate the natural motion of its target.
- Enhances the prospect of creating better designs and narrative.
- As recognized before, control is crucial in order to create dynamic and enhanced aesthetics in designs.

2. What are the main distinctions between the walk and run cycles that I should concentrate on?

Aspect	Walk Cycle	Run Cycle
Pace	Slower	Faster
Body Movement	Gentle rise and fall	Pronounced rise and fall
Foot Contact	One foot always on the ground	Flight phase with both feet off ground
Arm Swing	Opposite arm swings	Vigorous arm movements

3. How can I demonstrate a bird's flying cycle efficiently for the NID-DAT exam?

Demonstrate the following wing motions: downward stroke at the bottom, an upward stroke at the top and an optional glide in the middle of the line.

- Emphasise: Flexibility of wings.
- Feather motion.
- Body elevation and descent.

Mechanical Aptitude - Inclined Plane and Lever

Mechanical aptitude is defined as the ability to understand as well as make use of mechanical information and knowledge to solve problems. This ability is especially crucial for design aptitude tests since unlike previous aptitude tests which were used for the cognitive ability test, design aptitude test requires one to understand various mechanical systems before coming up with innovative and useful designs. In this article, we will look at different types of simple machines which are as follows: These basic gadgets alter a force's direction or magnitude to make tasks easier for a force to accomplish with less force or effort.

There are six categories of simple machines:

1. **Inclined Plane**
2. **Lever**
3. **Wedge**
4. **Pulley**
5. **Wheel and Axle**
6. **Screw**

Introduction

The questions related to the subject are asked, keeping elementary science related to daily life objects. Through this article, we will gradually revive all the concepts. In this article, we shall examine the above-mentioned primary machines. Recognising the uses of these devices in more sophisticated machinery and daily life will be made more accessible with an understanding of how they operate.

1. Inclined Plane

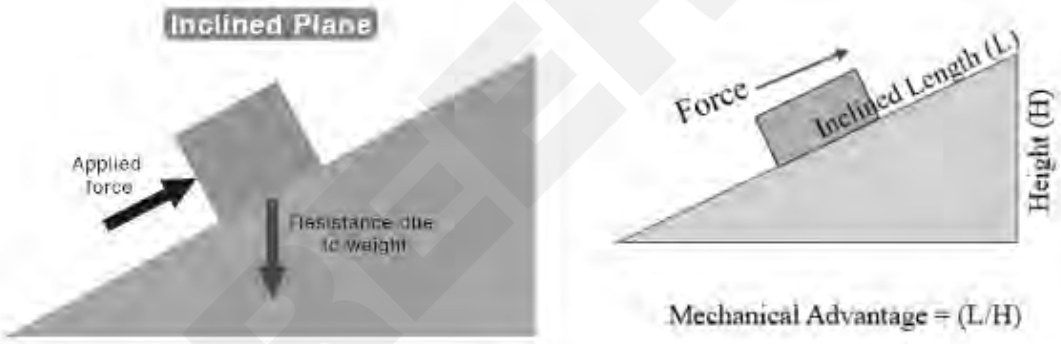
An inclined plane is a level surface angled relative to another level surface. It is often referred to as a ramp. An inclined plane's primary function is to increase the force applied over a greater distance, requiring less force to lift an object. Moving large objects to a higher or lower elevation is made more achievable by harvesting the Mechanical Advantage.

1a. Working Principle

Working against gravity happens when you push something up an inclined plane. But you move the thing along the aircraft, not up the vertical shaft. As a result, less force is required to raise the object because the effort is distributed over a greater distance.

One of the best examples is flyover bridges, where, while ascending, we feel a pullback, but on the descending side, we feel an assistive momentum.

The ratio of an inclined plane's length to its vertical height (rise) is called its Mechanical advantage.



Mechanical Advantage (MA) = [Length of Incline(L)/ Height of Incline(H)]

1b . Applications

There are several common uses for inclined planes:

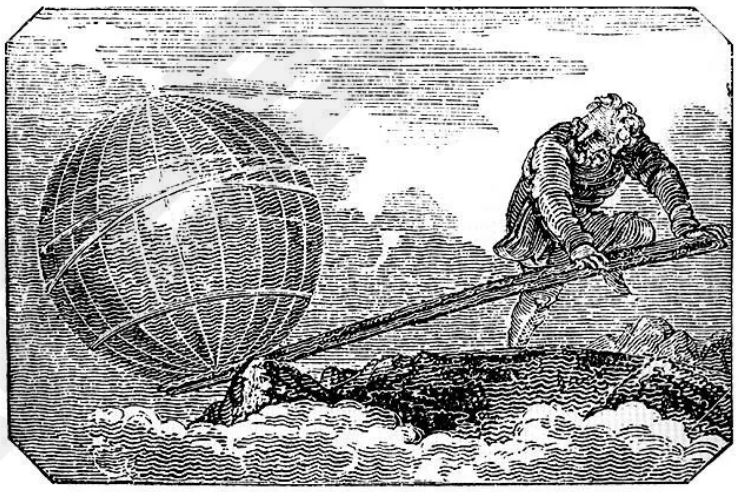
A. **Ramps:** Frequently utilised for wheelchair access, loading docks, and furniture relocation.
B. **Slides:** Slanted planes are frequently used as playground slides, enabling kids to go swiftly from a higher elevation to a lower one.

1c. Advantages

Reduced Effort: To move one object to far distances requires lesser force using inclined planes.
Usability: Operation, assembly, and working are very simple in wedges.
Versatility: The application of wedges is versatile, with the flexibility to adjust the length and angle for specific needs.

2. Levers

A lever is one of the most crucial simple machines, and it utilises the fulcrum point to amplify the input force to provide a greater output force. It is employed to move or raise objects with less effort. Three types of levers are distinguished based on the fulcrum's load, effort, and relative positions.

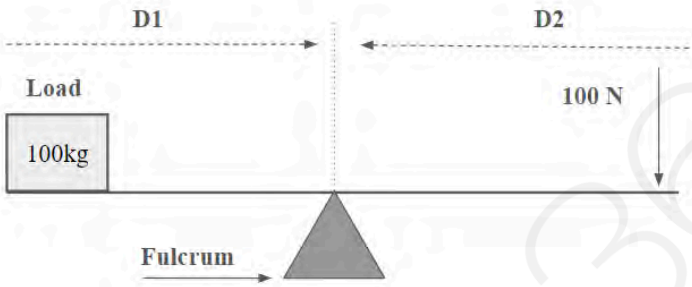


Archimedes Lever Illustration

2a. Working Principle

An input force must be changed into an output force for the lever to function. The ratio of the distances from the lever's fulcrum to the point of effort application and from the fulcrum to the end of load application indicates the lever's mechanical advantage.

*A lever Provides no mechanical advantage unless the position of **the Fulcrum point is adjusted more towards the Load.**
The fulcrum point should be shifted near the load to lift a heavier weight than the force required to get a mechanical advantage.



W X D1 = F X D2

W = Weight
F = Force Needed
D1 = Distance from Fulcrum point to Weight
D2 =Distance between Fulcrum point to Force applied

2b. Applications

- **Crowbars:** A tool for lifting and prying bulky items.
- **Seesaws:** A playground tool used to illustrate the operation of levers.
- **Scissors:** To cut materials, use two superior levers in tandem.
- **Wheelbarrows:** Move and carry big loads with minimal effort by using inferior levers.

2c. Advantages

- **Multiplication in Force** This simple machine is very useful in lifting heavier loads.
- **Versatility:** It can be manipulated to fit the particular requirements by shiting the fulcrum points as per the output required.
- **Simplicity**: It is simple to construct.

Mechanical Advantage:

The ratio of the distances from the lever's fulcrum to the point of effort application and from the fulcrum to the end of load application indicates the lever's mechanical advantage, as shown in the figure above.

$$\text{* Mechanical Advantage} = \frac{\text{Distance from Effort to Fulcrum}}{\text{Distance from Load to Fulcrum}}$$

Different Types of Levers

On the basis of the application of Load and Effort, Levers are classified into three classes, all with a different Mechanical Advantage. The classification is as follows:

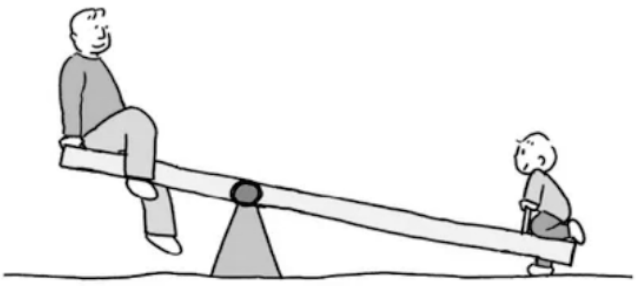
A. **First-Class Lever**
B. **Second Class Lever**
C. **Third Class Lever**

A. First-Class Lever

This class of lever has its fulcrum situated halfway between the applied force and the weight. A representation of its order is force-fulcrum-weight. This kind of lever is the simplest.

Example

- Crowbars, seesaws, or other objects.
- Pulling away a nail from a wooden plank is an example of a **First-Class Lever.**



Seesaw is good example of First-Class Levers

B. Second-Class Levers

In this Class of Levers, the force is exerted at one end and the fulcrum at the other. The middle of these two is where the weight is located. This would be done in fulcrum-weight-force order. The force applied at one end will cause work to be done at the other.

Example: Bottle opener and Hinges of Gates.

Bottle Opener: Second-Class Levers

C. Third-Class Lever

These are the levers where the weight is on one end of the lever, the fulcrum is at the other, and the force is applied in the middle of the lever. In this instance, we must exert more energy to move the weight to a large distance.

Example: Fishing Rod & Baseball Bat

Fishing Rod : Third-Class Lever

Conclusion

One can be able to understand the basic mechanics concepts through knowing some of the essential devices including the inclined plane and the lever. These technologies may seem quite simple, however, are essential for reducing costs in terms of labour and boosting efficiency. They are used widely in many daily and industrial applications and could be used to create other better quality gears. In inclined planes, levers they help in productivity and efficiency in work we do.

Q1 : How Much force is required to lift the weight in the given figure

Solution : **W X D1 = F X D2**

80 X 9 = F X 12m

(80X9)/12 = F

Force Required = 60 N

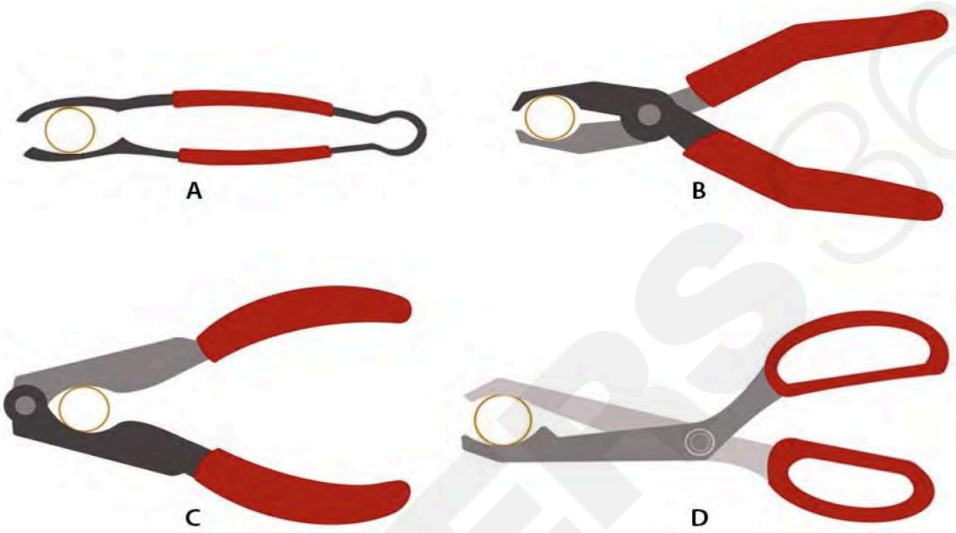
Sample Question

Q1: **For a given lever, the effort arm is 60 cm, and the load arm is 40 cm. Find its Mechanical advantage?**

Hint : **Mechanical Advantage** = (Effort Arm/Load Arm)

Q2: CEED -2023 (Question on Levers and Associated Mechanical Advantage)

Q.32 Image below shows four configurations for designing a nut cracker. Which option would require least amount of pressure to break the nut?



Mechanical Aptitude - Wedge, Pulleys & Springs

This study material is a continuation of the introduction and understanding of simple machines, notably the inclined planes and levers, as discussed in Part 01 of Simple Machines. This section will cover the other concepts, Applications, Advantages and Limitations of the "Wedges and Pulleys". Multiple questions have been asked on this topic in various DAT examinations.

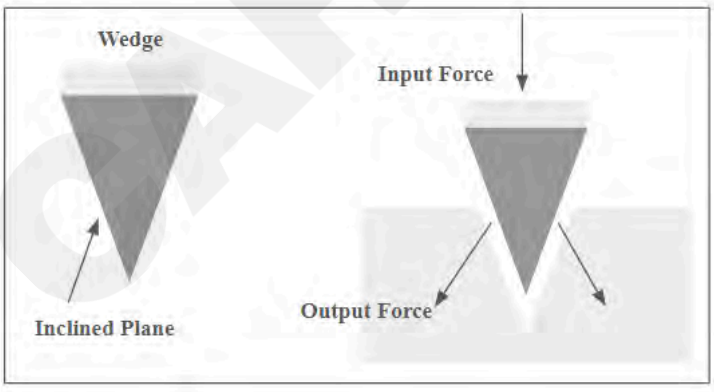
3. WEDGES

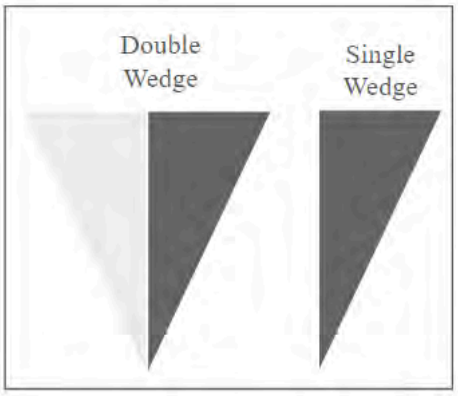
3a. Introduction

A wedge is a sharp shape inspired by a triangle as a tool of two inclined planes attached back to back. It helps split, cut and lift objects by transferring the force applied to its blunt side perpendicular to its slanted surfaces. The mechanical advantage of a wedge is determined by its ratio of wedge's length to width.

The sharper side of the wedge is inserted into the material when force is applied to the wedge's blunt side. The object/given material splits from the point of insertion of the wedge for the force being diverted sideways. Below the figure and formula, we will understand the Wedge's Mechanical Advantage and working mechanisms.

Mechanical Advantage (MA) = [Length of Wedge(L) / Width of Wedge (W)]





Note: A Thinner wedge, since it applies more force to the material being split, a longer, thinner wedge has a higher mechanical advantage.

3b. Application

Since Wedges can split and cut materials, wedges are frequently utilised in a variety of applications, as discussed below through the examples :

- **Axes and hatchets**: These are used to break logs, large chunks of wood, and other forced-based splitting of the wood.
- **Knives:** These are used in the shared kitchen to split and cut vegetables and meat.
- **Chisels**: These simple tools help cut and split metalworking, stone carving, and woodworking, as seen in everyday life.
- **Nails and staples:** use the principles of wedges to join two pieces of wood.

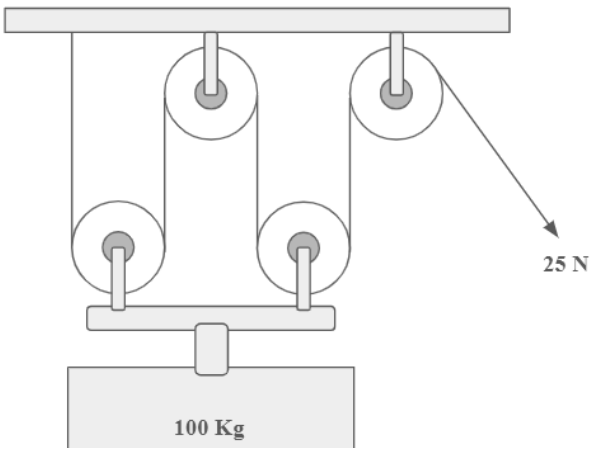
3c. Advantages

- **Efficiency**: The ability to split and cut materials with little force.
- **Versatility**: Useful for a variety of applications from household to everyday life.
- **Simplicity**: It is simple to use and application.

4. PULLEY

4a. Introduction

A pulley is fundamentally a wheel-based mechanism that grooves along its edges to allow a cable or rope to pass through. When a combination of pulleys is utilised in a system, they offer a mechanical advantage in addition to being used to shift the direction of a force and, thus, make the lifting easier, providing a mechanical advantage. A large amount of load can be lifted and moved with less effort if a combination of pulleys is designed to provide the mechanical advantage.



Note: It is simple to lift or move large objects when a pulley is used because it reverses the direction of the force applied to the rope or cable, which is called a block and tackle system. A block and tackle system increases mechanical advantage by combining several pulleys, so a smaller input force may raise a more significant load. The mechanical advantage of the pulleys is the ratio of Load to Efforts

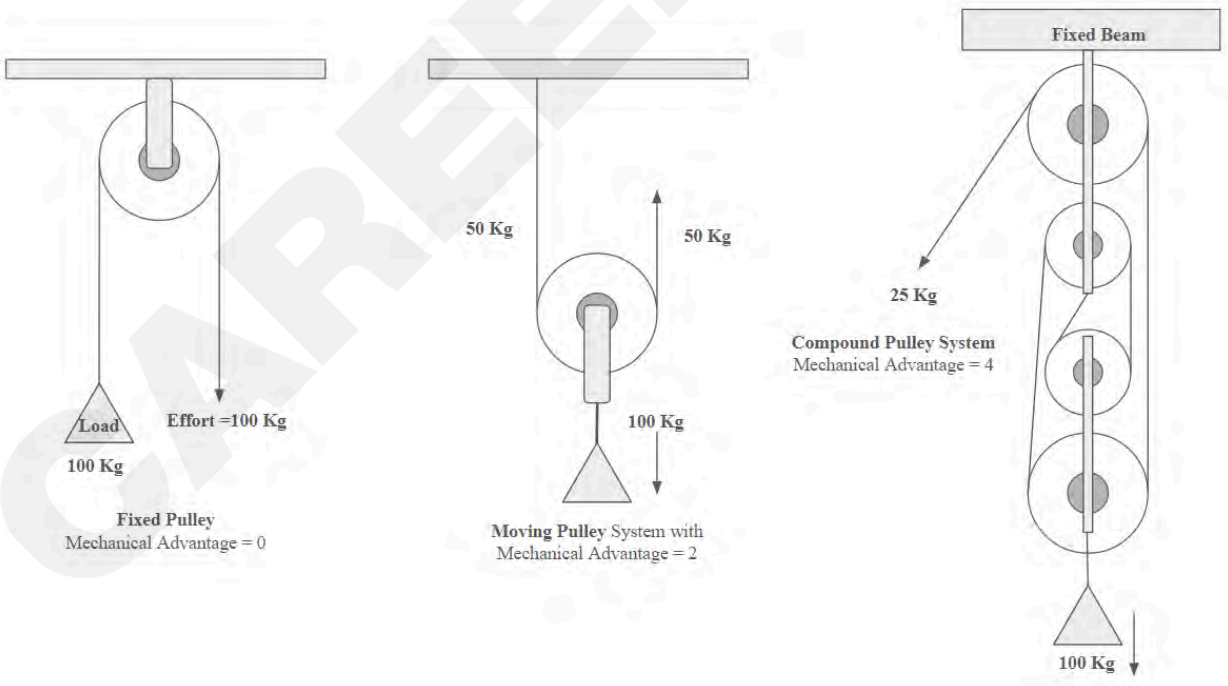
Mechanical Advantage (MA) = [Load/Effort]

Different Types of Pulleys

a. **Fixed Pulley:** The pulley reverses the direction of applied force while the wheel remains fixed in place. A single fixed pulley offers no mechanical advantage.

b. **Moveable Pulley:** By moving with the weight, the wheel lessens the force required to raise the load. A single moving pulley offers a two-fold mechanical benefit.

c. **A compound Pulley** is a set of fixed and moveable pulleys that spreads the load over several ropes to provide a greater mechanical advantage.



4b. Application of Pulleys

Pulleys are used in several applications, notably for lifting and moving large loads from one place to another.

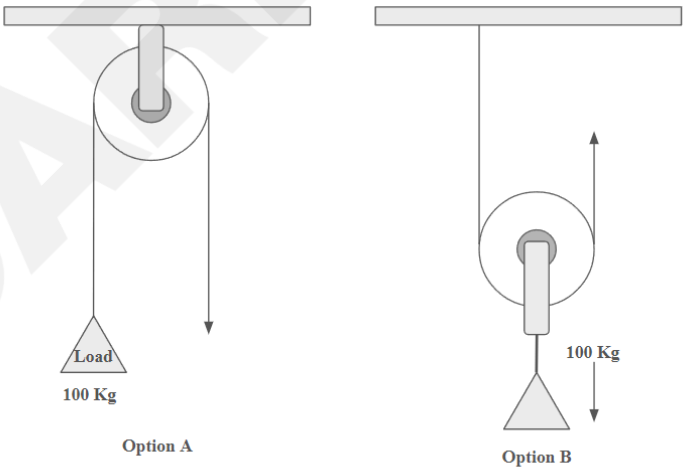
- **Cranes**: A large machine that lifts heavy masses to the desired locations using a combination of motor-controlled pulleys to achieve the task.
- **Elevators**: Elevators in the building use the pulleys for operation.
- **Flagpoles**: Are operated for lowering and raising the poles using a combination of pulleys.

4c. Advantages

- **Mechanical Advantage:** Drastically reduce the force required to raise heavy loads.
- **Versatility:** It can be used in a number of applications with minor or no changes in the operation principle to achieve a variety of results related to lifting.
- **Direction Change:** It is a crucial feature where in many applications, the direction of force is reversed as per requirements.

Sample Questions

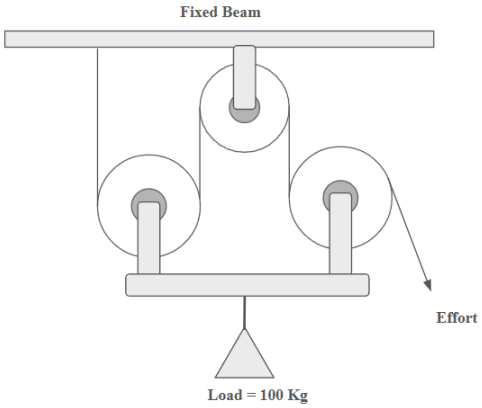
Q1: Which Weight requires the lesser force to move?



Answer: B

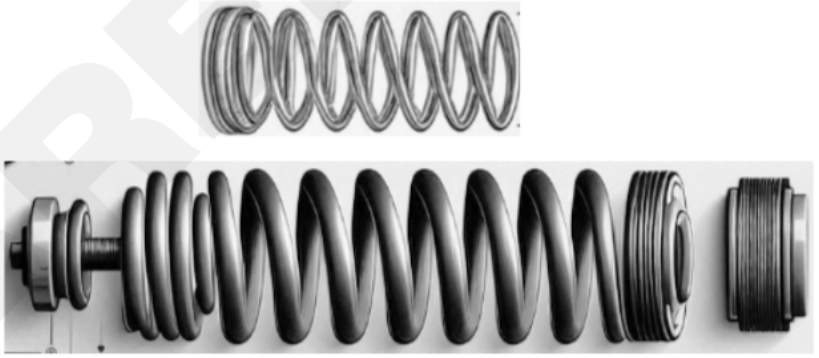
(For a Mechanical Advantage of 2, the force required in option B is half the load, i.e. 50kg)

Q2: Calculate the effort required to lift the weight of 100 kg for a combination of pulleys, as shown below.



5. SPRINGS

Springs are mechanical components with energy storage and release capabilities. They are made of elastic materials and revert to their original configuration when compressed, stretched, or twisted. Springs are employed in many applications to store energy, maintain force, and absorb shock.



Working Principle: Hooke's Law

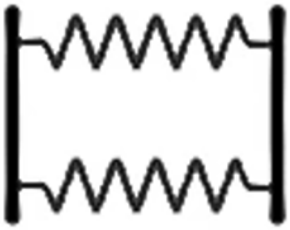
By the law, a spring's force is directly proportional to its displacement from its equilibrium position and is the basis for how springs work.

F(Force) = **kX**
k = Spring Constant(i.e. Stiffness of Spring)
X = Displacement of Spring

5a. Combination of Springs

For a combination of more than one spring, the springs can be arranged in Series or Parallel with different responses to loading conditions.

Springs in **Series**



Springs in **Parallel**

Different Loading Conditions

a. **For Series Combination of Springs :**
Springs are in series when they are joined end to end. Consider that you have two springs connected in succession, like in this example:

If you pull on the free end of Spring 2, the force you apply is the same on both springs. However, the total stretch (deformation) of this combined system is the sum of the stretches of each spring. Therefore, if Spring 1 stretched by 2 cm and Spring 2 stretched by 3 cm, the total stretch is calculated as follows :

2 cm deformation **3 cm** deformation

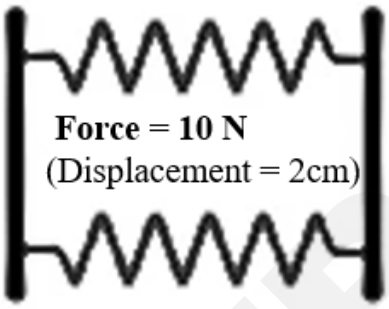
Springs in **Series**

Total Deformation = 2 cm+3 cm
= 5cm

b. Parallel Combination of Springs :

Springs are placed in parallel when they are joined side by side of each other as shown in the image below. Consider that you have two springs with their ends connected to the same points, as shown below.

For such a combination If you pull on both springs simultaneously, they will stretch by the same amount. However, the total force the combined springs can handle is the sum of each spring's forces. So, if Spring 1 can handle a force of 5 N (newtons) and Spring 2 can hold a force of 10 N, the system can handle 15 N for equal displacements.



Force = 5 N
(Displacement = 2cm)

Total Force = 15 N
Total Displacement = 2 cm

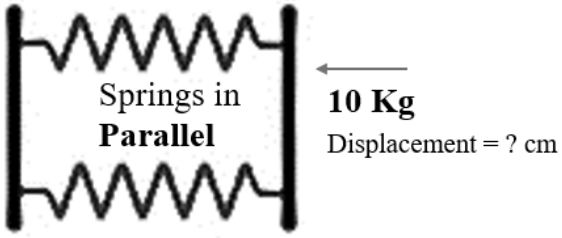
5b. Different Types of Springs

- **Compression-Based Springs:** Designed to withstand compressive loads and expand back to their initial length upon release of the force applied.
- **Extension-Based Springs:** Made to withstand tensile stresses and revert to their initial length upon removing the loading conditions.
- **Torsional Springs:** Manufactured to withstand twisting pressures and revert to their initial configuration upon force release.
- **Constant Force Springs:** Provide a continuous force for a range of motion restricting the free play.

Sample Questions

Q1: A force of 10 Kg compresses the springs attached in series by 5 cm. What would be the displacement of the two springs in parallel when an equal load compresses the springs in parallel?

Springs in **Series**



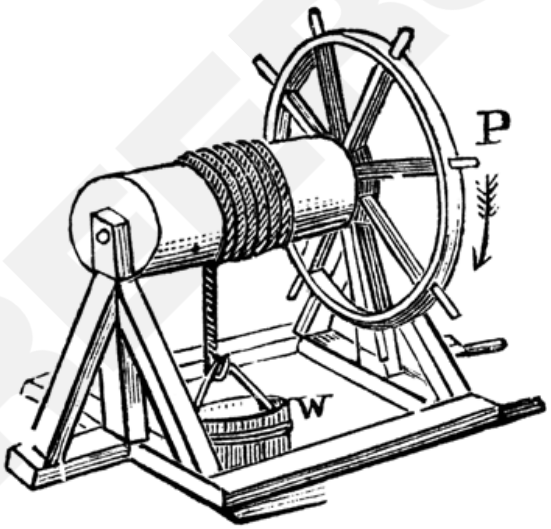
Mechanical Aptitude - Wheel-Axle, Screw & Gears

6. WHEEL & AXLE

6a. Introduction

The axle and wheel are a type of Simple Machine with a circular wheel attached to the axle. This combination provides a mechanical advantage for lifting the loads for which the required force is less than the object's weight.

The torque produced, also called the rotational force, is created when force is applied to the wheel, which turns the axle attached to it. Since there is a difference in the size of the wheel and axle, this implies that the two individual units are moving in the same amount of time is different. The reason for this is the difference in the circumference of the wheel and axle, which acts as a mechanical advantage, as shown in the figure below.



Mechanical Advantage (MA) = [Radius of Wheel / Radius of Axle]

***This implies that, compared to a smaller wheel, a larger wheel will take less force to move the same load.**

6b. Application

The wheel and axle are utilised in everyday life, as discussed in the example below :

- **Automobiles**: Wheels on bicycles, cars, and other vehicles reduce the drag and enable the rolling motion for higher loads.
- **Doorknobs**: The spindle (axle) in the door knob takes the mechanical advantage of the difference in circumference of the knob and the spindle to facilitate the locking and unlocking in a more accessible manner.
- **Wrenches**: Utilises the principle of Wheel and Axle to tighten or loosen a bolt or nut, converting the handle into a type of wheel.
- **Windlasses:** As shown above in the example, a device utilises the system to draw/pull the water out of the well.

6c. Advantages

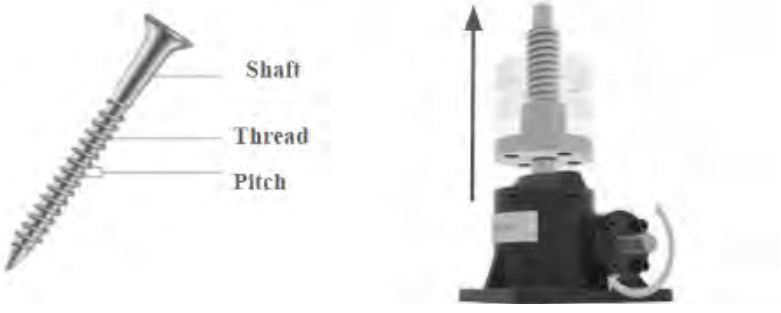
- Significant **mechanical advantage** caters for the easy lifting of heavy objects.
- **Versatility**: Adaptable to several applications and the foundation of modern machines.
- **Friction Reduction**: By reducing the amount of friction between surfaces, wheels facilitate easy movement

  .

7. SCREW

7a. Introduction

The screw is an example of a Simple machine that converts rotational force into linear movement. It consists of a helical thread, unlike an inclined plane revolving around a cylindrical axis. The force is applied using screws in a controlled way to lift loads as well as to hold objects together. The diameter of the shaft and the distance between threads, also called pitch, are used to determine a screw's mechanical advantage.



A screw advances or retreats when it is turned because the inclined plane (threads) changes the rotational force to a linearly applied force. A screw's mechanical advantage can be computed as follows.

Mechanical Advantage = Circumference of Shaft of Screw/ Pitch of the Screw

7b. Application

The screw has multiple applications as discussed below :

- **Fastening**: In construction and fixing of furniture, for instance, screws are often used to hold materials together.
- **Lifting**: Screw jacks can be used to lift or lower heavy loads through the turning of the screw.
- **Machines**: Screws are applied in machines to regulate motion, apply force and change the shape of the specific part.
- **Bottle Caps**: Screw-type bottle caps twist to reveal threaded surfaces that effectively close containers tightly.

7c. Advantages

- **Mechanical Advantage:** Screws are advantageous in terms of mechanical advantage that allows for the application of force and lifting of loads.
- **Precision:** Screws make the application of force and control of movement possible.
- Screws are very useful, and they can be used on a variety of materials and with different uses.
- **Diverse Applications**: Screws are common and can be used with almost every material and in nearly every application.

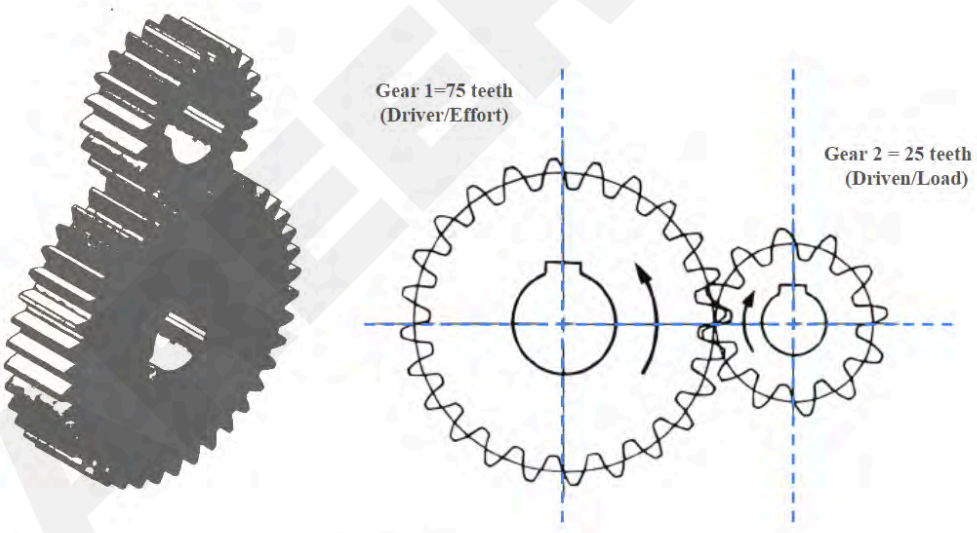
8. GEARS

8a. Introduction

Gears are one of the most significant factors for torque transfer and Speed Exchange. This is because when the driver gear is turned, the teeth of the driver gear push against the teeth of the driven gear and thus cause the driven gear to turn in the opposite direction. The system's speed and mechanical advantage are defined by the number of teeth on the gears and the number of gears in the system.

Gear Ratio can be computed as follows :

Gear Ratio = [Teeth in Driven Gear/ Teeth in Driving Gear]
Gear Ratio = 25/75
= 1:3 (proportionately, the speed varies)



Spur Gear

Important to know: Gears Type

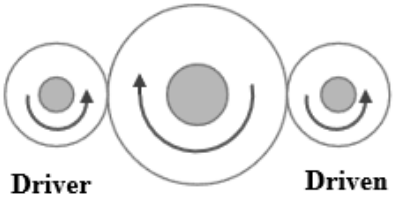
- **Spur Gears** transfer motion between parallel shafts and have straight teeth.
- **Helical gears**: Operate more smoothly and silently thanks to their inclined teeth that engage more gradually.
- **Bevel gears**: Conical in shape, they transfer motion at right angles between intersecting shafts.

- **Worm Gears**: Having a screw (worm) that meshes with a gear (worm wheel), worm gears can self-lock and offer high reduction ratios.

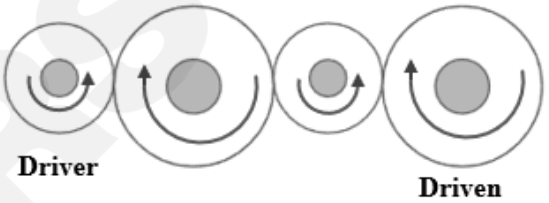
Trick to find Direction of Gear Rotation

1. **Even combinations of gears always rotate in the opposite direction**. For Example, if the driver gear is rotating in an anticlockwise direction in a combination of gears, the last driven gear would be rotating clockwise(opposite direction).

2. **Odd combinations of gears always rotate in the same direction**. For Example, if the driver gear is rotating in a clockwise direction in an odd combination of gears, the last driven gear would also be rotating in the clockwise(opposite direction).



Odd Combination of Gears (3)
Direction of Rotation is same
for Driver & Driven Gear



Even Combination of Gears (4)
Direction of Rotation is opposite
for Driver & Driven Gear

8b. Application

Since gears transfer force and motion, they are used in many processes.

- **Automobiles**: The wheels are driven by the engine's speed and torque, which are controlled by gears in the transmission system.
- **Watches and clocks**: The hand movement is regulated through gears to measure the time well.
- **Machinery**: Industrial gears are used in the machinery to provide and control the movement of various parts.
- **Bicycles:** Bicycle gear systems enable riders to change the effort required to pedal depending on the terrain.

Spur Gear : Watches

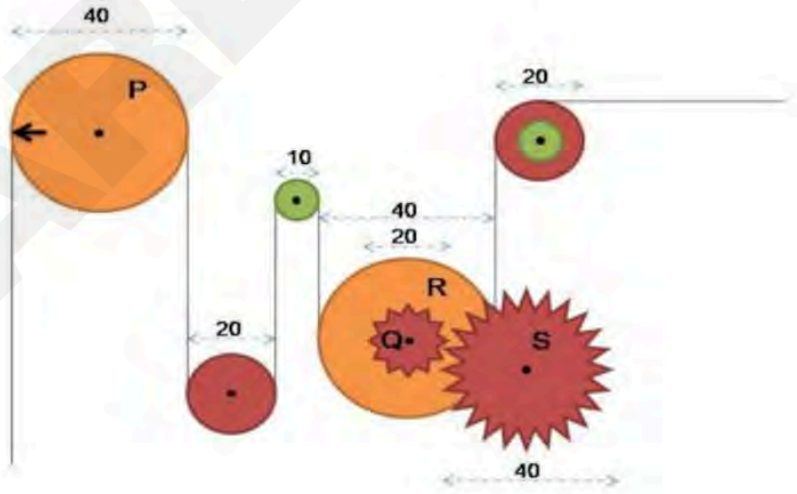
Watches use a combination of gears called Gear Train. The essential part of the gear train is responsible for transferring the mainspring's force to the balance wheel and calculating the balance wheel's swings to measure time.

8c. Advantages

- **Efficiency**: Extremely effective at transferring force and motion.
- **Precision**: Precise management of torque and speed.
- **Versatility**: Employed in a range of settings and applications.

CEED 2021
(Question Mechanical Aptitude using the concept of Gears & pulleys)

Q1 : Gear Q is fixed on the pulley R. If pulley P undergoes 4.5 full rotations, how many rotations will gear S undergo?



Q2: If the Gear X rotates at the constant speed of 20 RPM, the Gear Y will turn…?

A. Clockwise 10 RPM
B. Anticloclwise 20 RPM
C. Cloclwise 20 RPM
D. Anticlockwise 5 PRM

Indian Traditional Painting Styles

Today many techniques of traditional paintings in Indian art has become a rich heritage after centuries of practice. Thus, it is possible to claim that each style tells another story that demonstrates the multifaceted and rich character of India's roots. This is particularly important in the understanding of these conventional painting styles depending on whether one would like to teach in the filed of design or prepare to write the Design Aptitude Tests (DAT). This article looks at some of the best traditional Indian paintings, the renowned painters and some of their beautiful paintings.

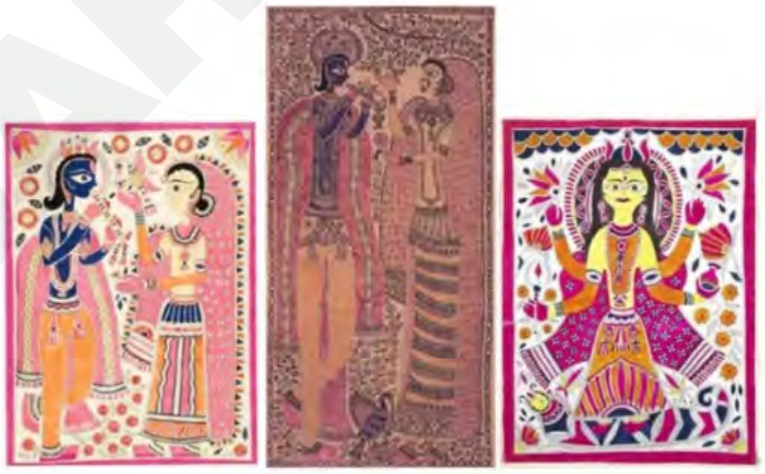
1. Madhubani Painting

This painting style is also called Mithila painting, its features involve elaborate ornament and the use of a wide range of bright colours.

Region of Origin: Bihar's Mithila region.

Unique Attributes: Done with brushing, finger, twig or match stick; subjects range from mythology, wildlife, and folklore; they use natural dye and pigment.

Important Painters and Paintings: One of the most dramatic painters of India, Sita Devi who specialized in depicting deeper aspects of Hindu mythology.



Sita Devi Works from collections on Madhubani Paintings

2. Warli Painting

Region of Origin: Warli tribes, Maharashtra

Unique Attributes: The basic colour and monochromic patterns were made from white pigment on matt-looking backgrounds of mud, charcoal, and cow dung. This is a use of geometric shapes in portraying real-life situations such as farming, dances and rituals.

Important Paintings and Painters: Jivya Soma Mashe is a Warli painter, who gained appreciation from all over the world through his paintings, which speak in detail the essence of the Warli tribal community.

Untitled(Goddess Palaghata in a Devchauk) **: Jivya Soma Mashe: c. 1990's**

3. Pattachitra

Region of Origin: Odisha and West Bengal.

Unique Attributes: This antique form of pictorial artwork is intricate and highly representative and entails a depiction of legends and heroes often with large, bold strokes clearly and accurately rendered. made up of natural pigments on canvas or dried palm fibres.

Important Paintings and Painters: Art has been the key element in the progression of the art form and keeping it alive is the contribution made by Raghunath Mohapatra, a well-recognized artist in this regard.

Pattachitra Painting : A great Storytelling from Odisha

4. Rajasthani Miniature Painting

Region of Origin: Rajasthan

Unique Attributes: These paintings are highly recognized for their smooth brushwork and brilliant use of colours; most of the paintings depict Hindu mythology, court scenes and portraits of royalties.

Important Paintings and Painters: A special focus can be made on the Kishangarh style which is characterized by dreamy images of Radha and Krishna painted by Nihal Chand using bright and detailed painting.

Detail of the Portrait of Maharaja Savant Singh with Consort, Bani Thani,
ca. mid-1700s, Kishangarh School (Rajasthan, India), Courtesy : Cleveland Museum Art

5. Phad Painting

Region of Origin: Rajasthan

Unique Attributes: Creation myths and stories of local gods and legends are depicted in large flat scroll paintings that are used as a medium for telling a story. that are filled with bright and powerful images and many elaborate storylines.

Important Paintings and Painters: Some of the sculptures created by one of the most famous phad artists Shree Lal Joshi have been quite instrumental towards the revival of this rather traditional form of art.

Pabuji Rathore, Rajput King : Forms of Devotion by Shree Lal Joshi

6. Kalamkari Painting

Region of Origin: Andhra Pradesh.

Unique Attributes: The technique of artwork on fabric using body paints or wooden blocks to create aesthetical designs with natural colours. In most of the times they incorporate elaborate designs of plants and animals combined with Hindu epics.

Important Paintings and Painters: The leading artist is Kalamkari artist J. Niranjan who is known for designing the most detailed and bright patterns.

Kalamkari Painting, Source : https://blog.artlounge.in/blog/2021/4/3/indian-art-form-kalamkari

7. Tanjore Painting

Region of Origin: Tamil Nadu.

Unique Attributes: Often, gold foil is used to depict Hindu deities and their attributes in a very explicit manner, and these are highly praised for their rich colours, depth of surface patina and miniature construction.

Important Paintings and Painters: Rajam is a famous painter belonging to the Tanjore School and her paintings define the overpowering elaboration of the Tanjore style in its true sense.

Raja Alangaram Murugan Tanjore Paintings & Raja Murugan Tanjore Paintings

8. Bengal Patachitra

Region of Origin: West Bengal.

Unique Attributes: There are one or two special features that characterize the method: It is also known as Kalighat painting It is characterised by a combination of black and red outlines with clear and bright colours used to develop themes concerning societal issues and cosmological rendering of mythology.

Important Paintings and Painters: A historian of art, Modernist painter Jamini Roy has taken portions of this style and incorporated these into his paintings.

9. Mysore Painting

Region of Origin: Karnataka

Unique Attributes: This painting was done using a thin foil of gold and concentrates on certain spots and is very elegant and beautiful like the Tanjore paintings.

Important Paintings and Painters: Keshaviah is best known for painting the most beautiful gods and goddesses, epic scenes of battle and love and any other scene from the 'purans'.

A Painting by Jamini Roy, Photo Courtesy : DAG Modern

10. Cheriyal Scroll Painting

Region of Origin: Telangana

Unique Attributes: Non-Western, pictorial art form that employs bright colours and heavy lines and tells a story from epics, mythology, and folklore using long scrolls.

Important Paintings and Painters: For this, credit goes to D. Vaikuntam and his distinct and detailed paintings that breathed life into this art style and motivated it further.

Cherial (Cheriyal) Scroll Painting, Cherial, Warnagal : Photo Courtesy : https://rangandatta.wordpress.com/

11. Bhil Painting

Region of Origin: Bhil tribes in Madhya Pradesh, Gujarat, Maharashtra, and Rajasthan.

Unique Attributes: Depicts an image or a story in a frequent perspective of dots and lines, including tribal gods, nature, and ordinary vices.

Important Paintings and Painters: There is Bhuri Bai who is famous for her colourful elaborate paintings that portray and preserve the Bhil art.

Magar Aur Bandar Ki Kahani by Bhuri Bai
Photo Courtesy : mapacademy.io

12. Gond Painting

Region of Origin: Madhya Pradesh.

Unique Attributes: Tribal art gond paints use bold colours and intricate designs in an almost minute depiction of objects in their day-to-day life alongside plants. Often incorporate lines and dots in order to work direction and more structure into your picture.

Important Paintings and Painters: Jangarh Singh Shyam can also be named one of the most famous Gond artists, whose works brought this type of art to the international level. In most of his paintings, he incorporates scenes from the life of the Gond people, their gods, and the environment.

13. Chittara Painting

Region of Origin: Karnataka.

Unique Attributes: The Chittara painting is well done by the Devaru community and is a form of painting where geometrical patterns are finely painted on naturally painted handmade paper. This is true because their artworks contain themes of daily life, fertility and even rituals/ ceremonies.

Important Paintings and Painters: Chittaras in the majority are painted by the women of the Devaru community. Leading painters such as Kamala Chinchure have significantly contributed to the preservation and furthering of this historical art genre.

Chittara Painting Style, Photo Courtesy : Shutterstock

14. Kerala Mural Painting

Region of Origin: Kerala

Unique Attributes: Kerala mural paintings are characterized by bright colours, and excellent workmanship and are traditionally religious in nature; They often depict Hindu gods and goddesses. These paintings are in 'Ajanta and Dravidian styles' It was painted on the walls of temples with natural colours.

Important Paintings and Painters: The two best examples of mural painting are located in Padmanabhapuram Palace and Mattancherry Palace. Mammiyoor Krishnan Kutty Nair is a reputed muralist, who has been the key person behind the revival of this somewhat outdated art form.

15. Pichwai Painting

Region of Origin: Rajasthan

Unique Attributes: Pichwai paintings are highly detailed and are painted to narrate stories about Lord Krishna especially from his childhood to his teenage stage. These paintings, often used as wall paintings in temples, are large, bright and detailed works of art.

Important Paintings and Painters: Pichwai painting is focused on Nathdwara, here more than a thousand artisans create very large fabric paintings. Bhupendra Sharma a Pichwai artist who specialises in painting of Lord Krishna is quite popular, and his work is characterised by bright colours and detailed images.

Conclusion

These traditional paintings give a peek view of the rich Indian culture and tradition of paintings. It is helpful for prospective designers to study these styles to understand the concept of colour, composition and narrative. Starting from the basic geometric patterns of Warli to the intricate and complex designs of Rajasthani Miniature paintings and the illustration of great Hindu epics in Pattachitra, these historic designs are still considered references in modern design. Learning and recognising these art forms increases the dimension of design vocabulary and also strengthens bonds towards the cultural heritage of India.

Orthographic and Isometric Projections and Views

Drawing in a manner that depicts objects in a three dimensional world onto a two dimensional plane is a valuable skill in design. This is made possible by projections and views which enables engineers, architect, designers, artists, and others to visualize, describe, and work more effectively on the ideas. These methods are critical in creating elaborate and clear drawings in reference to the shape, arrangement and functionality of objects and spaces.

Understanding of projections and views facilitates the process of transforming complex three-dimensional ideas into easily actionable and comprehensible two-dimensional models thus bridging the gap between the idea and real life. It also helps the designer to realise that his or her concept can be broadly understood in order to deliver the overall vision more effectively.

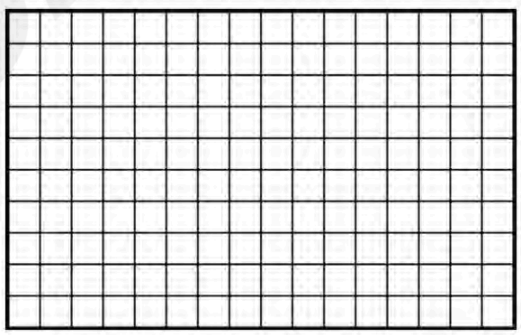
Projection: Types, Definitions and Applications

What is a Projection?

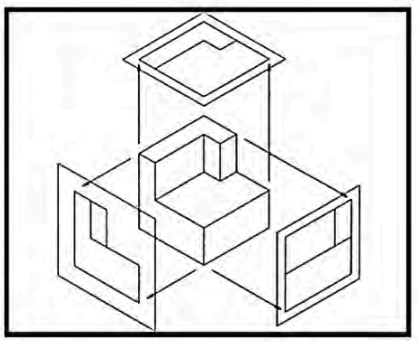
Projection means to transfer three-dimensional objects on to Two dimensional planes by Orthographic, Isometric and Perspective Projection Techniques. As such, each step captures relative sizes and relative positions, which is important when making technical drawing, building plans, and design drawings.

Different Types of Projections:

1. **Orthographic Projection:** It includes an extension of edges of the object's features onto perpendicular planes.

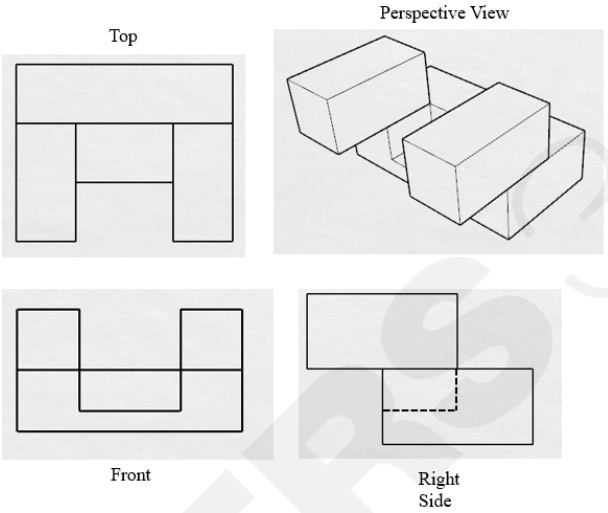


This is square grid for orthographic projections to be made



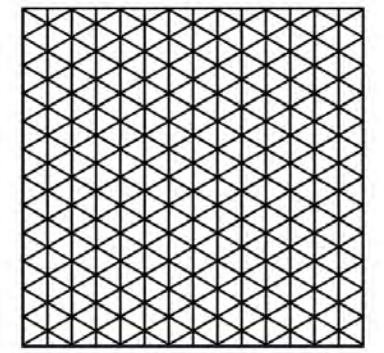
It shows different views (Front- Side) without Perspective Distortion.

Application: Standardly employed in drafting maps, structural plans and layouts, mechanical designs, architectural designs among other fields to indicate measurements as well as positions of various parts of an item.
Example - Orthographic projection can only be understood better and made more precise when different views of the form of a solid are projects as shown below.

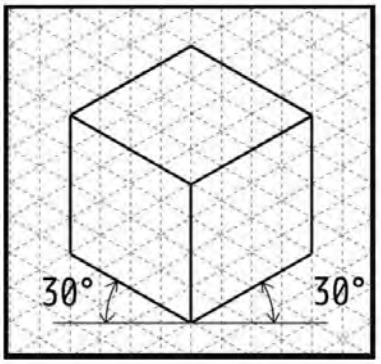


2. **Isometric Projection:** Isometric projection is mapping three dimensional objects onto two dimensional plane.

   The angles between the projection axes consist of 30 degrees, and all the projection axes are proportionally scaled, and thus do not distort proportions.

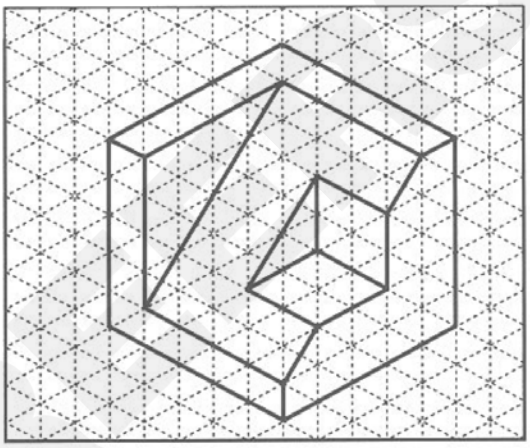


This triangle grid for Isometric Projection to be made



Application: Often applied in a technical drawing, CAD model, and other games design to provide a perception of the object and form a proper concept of the geometry of the object and its location.

Example - Here, a solid is made in isometric projection and the figure shows that the sides as well as the angles of the solid are not distorted and have been made proportional to each other; thus the size of every side is clear and easy to understand.



Projection Methods: Ist and Third Angle

In technical drawing, the following projection techniques can be used in the conventional way in regard to the standard representation of three-dimensional objects on two-dimensional planes.

1. **First Angle Projection**
2. **Third Angle Projection**

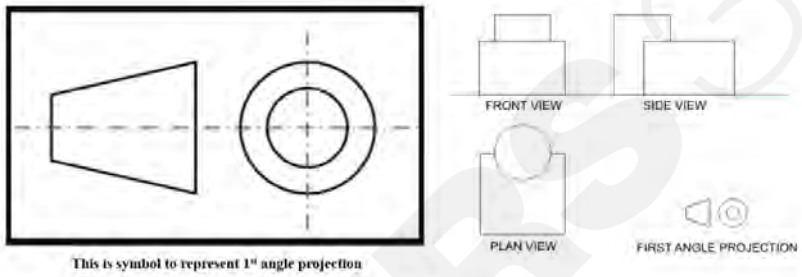
Appreciating and applying these projection methods to technical drawing guarantees that it is clear, standard and worldwide understandable making accurate manufacturing and construction possible.

1. First Angle Projection

In the first angle projection it is placed in the first quadrant. The planes of projection are conceived between the watcher and the observed.

Representation

- The front view is placed in the middle as is the case of figure 2 below.
- The next view, top view, is located at a lower position than the front view.
- The right side view is aligned on an area that is set just below and to the left side of the frontal view.



Application:

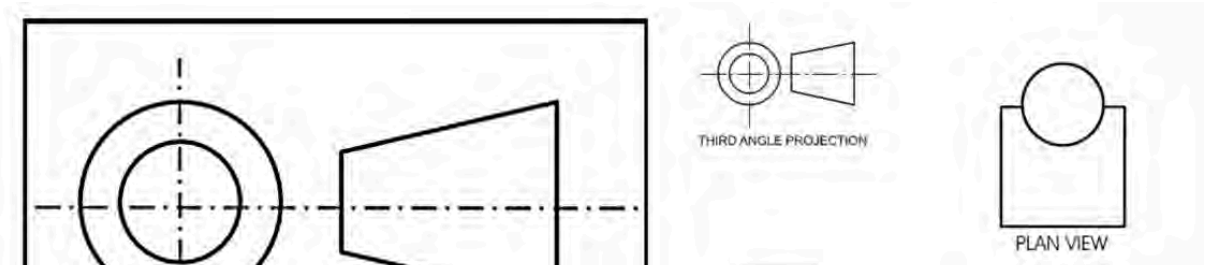
- European and Asian countries are the ones who have adopted the use of such products most often.
- It is ideal for mechanical and architectural drawings where regional practices standardise the projection method.

2. Third Angle Projection

Then the object is positioned in the third quadrant of the third angle projection. With respect to these planes of projection, the discerned planes of projection are thought to be behind the object.

Representation:

- The view of the front is then pasted at the middle of the object.
- Just as stated earlier, the front view is positioned above the top view.
- Right side view is positioned below and on right side of front view.



Application:

- Standard method of presentation used commonly in United States of America and Canada.
- Favoured in manufacturing and engineering disciplines as this type of format is easy to follow.

Views: Types, Definitions and Applications

It is essential to comprehend the plan, elevation, section, and exploded views for DAT tests. Students can better visualise and use spatial reasoning through these perspectives by seeing objects from various perspectives. Analysing shapes, structures, and relationships requires this ability. It facilitates creative problem-solving and successful communication of design ideas. Gaining confidence in these viewpoints is essential for DAT exam success.

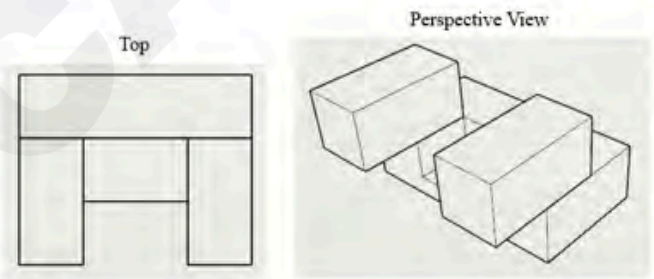
1. Plan
2. Elevation
3. Section View
4. Exploded View

1. Plan (Top View)

1a. Introduction

A plan view is a top-down projection that displays the organisation and layout of an object or space. Picture yourself glancing down at a house's floor plan, which shows where the walls and rooms are located.

1b. Application: Used in architectural plans, landscape designs, and floor layouts to show the arrangement of spaces and elements from above.



Show above is the Top View(plan) used in Technical drawings,On the right is an illustration of a bird's Eye view.

Important Note:

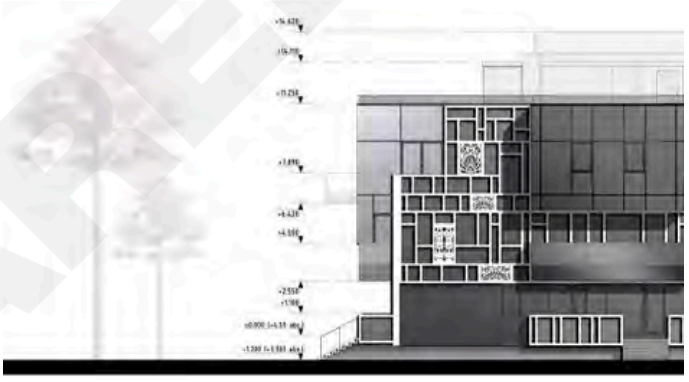
Although "Plan" and "Bird's eye view" are sometimes used synonymously, there is little distinction.

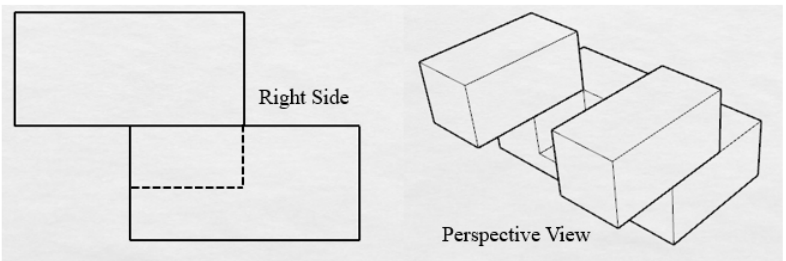
- Not all bird's eye views are plans, even though all plans are bird's eye views. A plan is an overhead view with precise technical information and a defined function.

2. Elevation(Side View)

An elevation is a technical drawing that shows a structure or object from a vertical perspective. You are staring straight at one side, revealing its height, shape, and details. For example, a building's front elevation shows how its windows, doors, and other architectural details appear from the outside.

Elevations are essential for design visualisation since they help to comprehend an object's general shape and dimensions. Stakeholders must understand the design intent.





Application: Common in architectural elevations, building facades, and interior design to show height, structure, and vertical relationships.

3. Section View

3a. Introduction

Section View is a popular visualisation technique that helps understand the internal makeup of an object through its cut section. The visual depiction of a theoretical section through a form it offers insights into its composition and organisation.

For example, To know a gear's cross-section, the section view makes it easier to see the tooth profiles and material distribution, which are essential for design analysis and understanding of the Functionality of an object.

Section View of **Nut**

3b. Objective

- Shows internal features by cutting through the object.
- It can be partial or total, depending on the extent of the cut.
- Typically, it includes hatching or shading to indicate the cut surfaces.

3c. Applications

- **Architecture:** Used to show internal layouts and structural elements like walls, floors, and staircases.

- **Engineering:** Highlights internal components of machinery, such as gears and shafts, aiding in the understanding of assembly and function.
- **Product Design:** Reveals the interior details of a product, which is crucial for manufacturing and assembly processes.

4. Exploded View

4a. Introduction

An "exploded view" is a technical drawing that displays an object's components in a deconstructed form, demonstrating how a complex object is assembled. As it develops spatial reasoning and an understanding of object building, it is essential for those aspiring to design. Candidates can examine existing designs, conceptualise new products, and properly explain design intent by visualising the interaction between different pieces. This ability is crucial for creativity and problem-solving in design.

4b. Characteristics:

- Illustrates how parts fit together and are assembled.
- Provides a clear understanding of the order and relationship between components.
- Often used in manuals and instructional guides.

Exploded view of a Mobiles

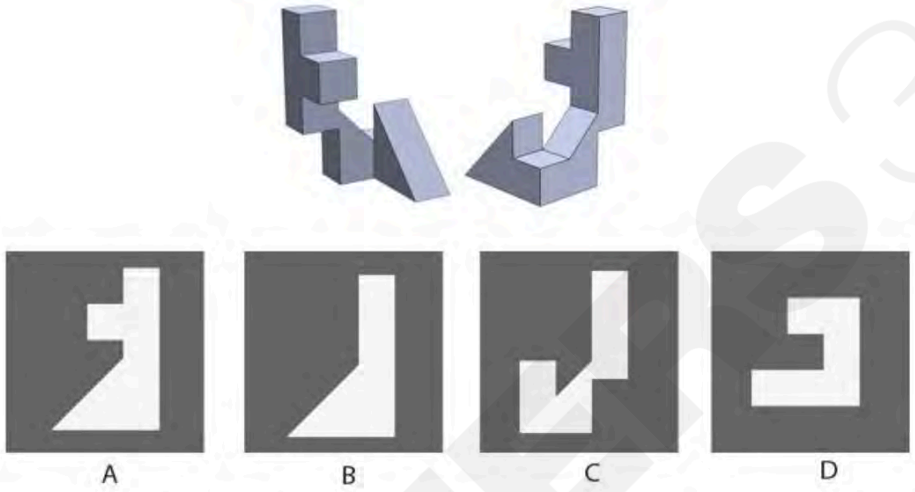
4c. Applications:

- **Assembly Instructions:** Common in DIY furniture assembly guides to show how pieces fit together.
- **Engineering:** Used to document the assembly process of complex machinery.
- **Product Design:** Assists in visualising product design and construction, helping troubleshoot and maintain.

Important Practise Questions from UCEED/NID

Q1 :

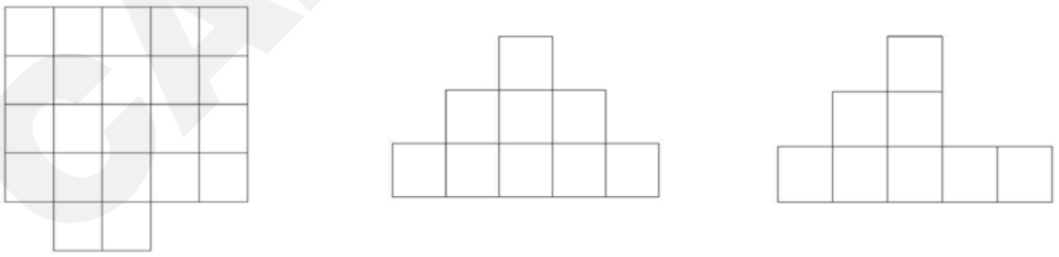
Shown below are 2 views of the same solid. Through which of the cutouts shown in the options, will the solid pass?



 # Hint - Here, you must imagine an elevation (side) view of the solid.

Q2:

Aman was playing with his building blocks. He made a structure, three views of which are given. So, how many blocks did Aman use eventually?



(A) 28 (B) 26 (C) 27 (D) 29

***Approach - It is a block counting question but orthographic views are given so you need to imagine this in 3-dimensional.**

Q3:

If a solid octahedron as shown in the figure is cut by a plane into two pieces, what is/are the possible shape(s) of the cross-section?

A. Triangle
B. Square
C. Pentagon
D. Hexagon

***Approach - Visualizing its cross-section by cutting it in planes.**

Important Geometry Concept for 2D Shapes

Comprehending fundamental geometric ideas is essential for candidates getting ready for design aptitude exams such as NID and U/CEED. The Understanding of basic geometric concepts is vital for NAT(Numerical Aptitude Test) in various DAT examinations conducted by most reputed D-Schools. You are a strong contender for these tests if you understand shapes, dimensions, and spatial relationships. This will improve your technical abilities and your creative capacity to produce successful design solutions.

Introduction to Basic Geometric Shapes

1. **CIRCLE:**

   A circle is a round shape where every point along its edge is equidistant from a central point.

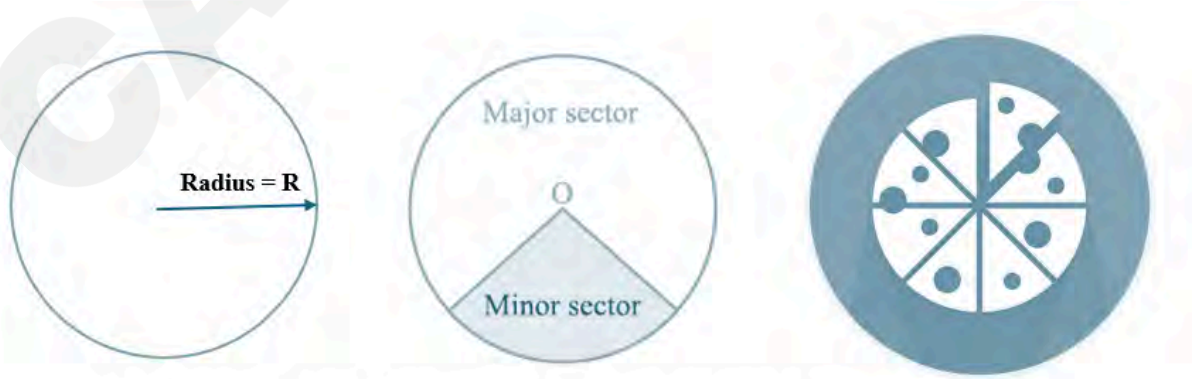
   Examples: Common examples of circles include coins, wheels, and clocks.

   Formula: Area = $\pi \times R^2$, where R is the radius.

Major Sector: A circle division with a centre angle larger than 180 degrees.

Minor Sector: A division of the circle distinguished by Less than 180° is the central angle that characterises it.

Let's understand this with an example of pizza and a slice. Consider the pizza as a full circle, and the slice can be considered a minor sector.



For a circle with radius R, understanding the concept of major and minor sector with pizza

Example: Understanding through an example of a Pizza cut

Calculating the Area of a Sector : $(\theta/360°) \times \pi r2$

Where θ = angle of the sector

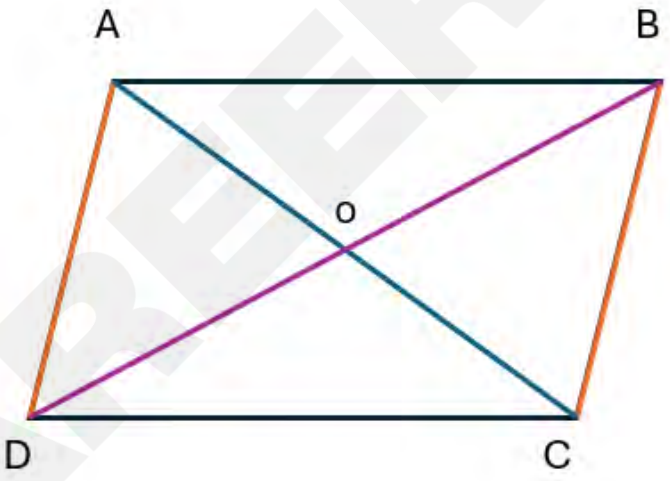
r = Radius of circle

2. **PARALLELOGRAM:** It is a four-sided polygon with parallel and equal opposite sides.

Properties of a Parallelogram

Understanding the properties of the parallelogram is required for the practical application as asked in diverse **Numerical Aptitude and Design Aptitude Sections** of the different examinations.

For the above parallelogram, consider the following properties:



1. **The opposing sides are parallel.**
   In this case, AB || DC & AD || BC

2. **In a parallelogram, the opposing sides are always equal.**
   In this case, AB=DC and AD=BC

3. **For a parallelogram, the opposite angles are equal.**
   In this case, $\angle A = \angle C$ and $\angle B = \angle D$

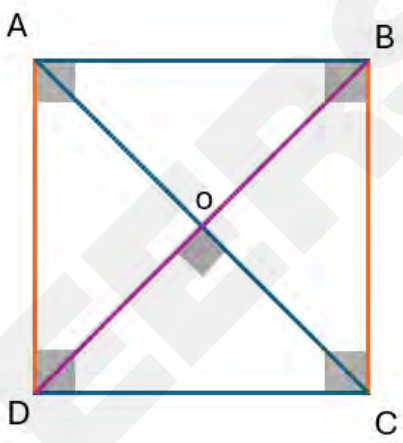
4. **A parallelogram's diagonals cut each other in half.**
In this case, AO = OC and BO = OD

5. Interior angles on the same side complement one another.
In this case, ∠ADC + ∠DCB = 180◦, Similarly ∠DCB + ∠CBA = 180◦,
∠CBA + ∠ABD = 180◦, ∠BAD + ∠ADC = 180◦.

6. The parallelogram is divided into two congruent triangles by the diagonals.
Here, ΔADB and ΔDCS are congruent, while ΔADC and ΔABC are congruent.
Classification of Parallelogram: It can be classified mainly into three distinct types as follows :

2a. Square
2b. Rectangle
2c. Rhombus

2a. Square :

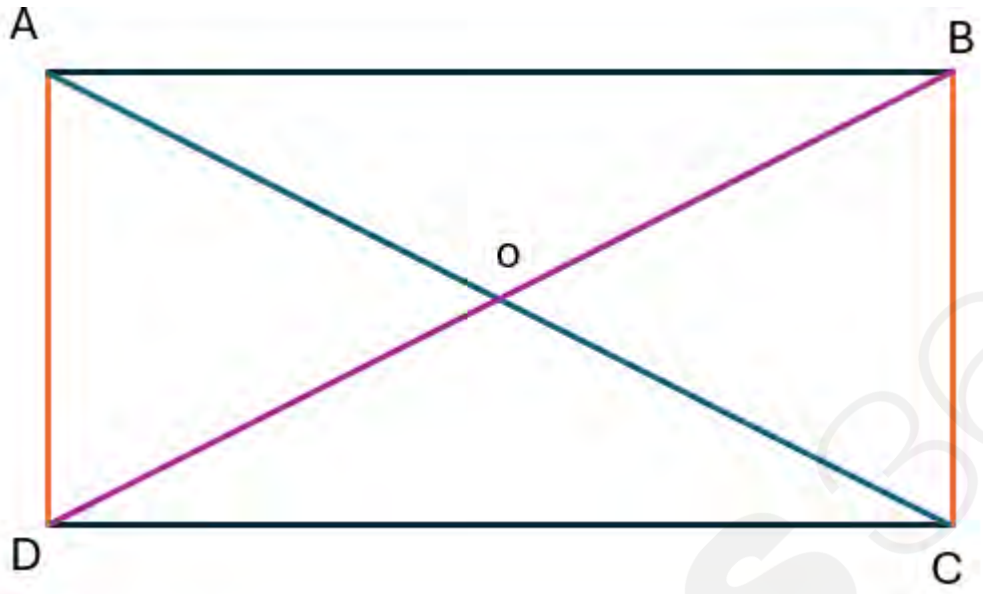


Examine the ABCD square and associate it with the subsequent attributes.
A square possesses the following properties:

1. Four equal sides. In this case, AB = BC = CD = DA
2. Four angles to the right. Here, ∠A = ∠B = ∠C = ∠D =90◦
3. Two sets of sides that are parallel to one another. In this case, AB || DC, AD || BC
4. A pair of diagonals that are equal. In this case, AC = BD.
5. Diagonals are perpendicular to one another. In this case, AC ⊥ BD
6. Diagonals bisect each other in half

Area of the Square = Side(AB) X Side(BC)
Perimeter of the Square = 4 X Side

2b. Rectangle



Examine the ABCD rectangle and associate it with the following characteristics. A rectangle possesses:

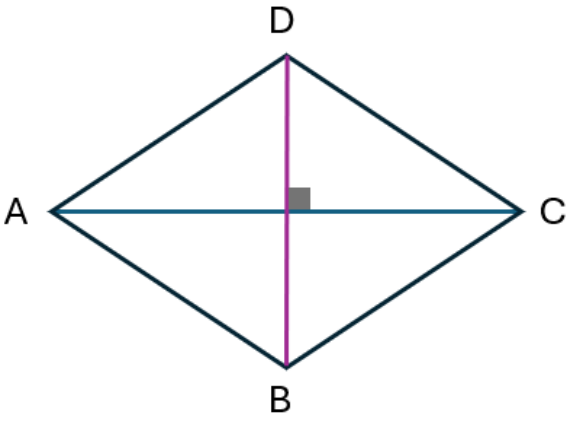
1. Two sets of sides that are parallel to one another. In this case, AB || DC, AD || BC
2. All Four angles are right angles. Here, $\angle A = \angle B = \angle C = \angle D = 90^\circ$
3. Opposite sides are equal in length. This time, AD = BC and AB = DC.
4. A pair of diagonals that are equal. In this case, AC = BD.
5. Diagonals that split others into half.

Area of the Rectangle = Length (DC) X Breath (AD)
The perimeter of the Rectangle = 2 (Length + Breadth)

2c. Rhombus

Examine the rhombus EFGH to associate it with the subsequent characteristics. A Rhombus possesses:

1. Two sets of sides that are parallel to one another. In this case, AB || DC and BC || AD
2. Four equal sides. Here, AB=BC=CD=DA



3. Opposite angles are equal, H = F and ∠E = ∠G
4. Diagonals run parallel to one another. In this case, AC⊥BD
5. Diagonals(AC & DB) split each other into two halves.

Area of the Rhombus = (Diagonal 1 **X** Diagonal 2) / 2
Perimeter of the Square = 4 X Side

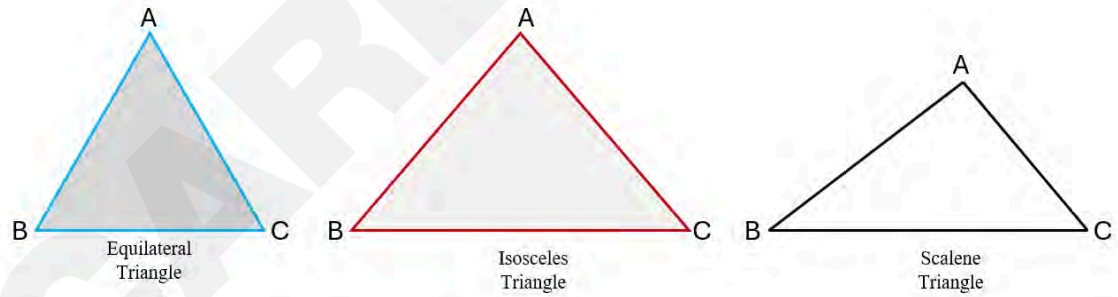
3. TRIANGLES

A triangle, one of the fundamental geometric shapes, is a polygon with three corners and three sides. The sides joining the corners, also known as edges, are one-dimensional line segments, whereas the corners, also known as vertices, are zero-dimensional points.

Classification of Triangles Based on Sides

3a. Isosceles Triangles
3b. Scalene Triangle
3c. Equilateral Triangle

We will cover the fundamentals of the triangles one by one to understand the basics for application:



Here in the below table, the properties & Areas of different types of Triangle is covered :

Triangle Type	Properties	Area Formula	Example
Isosceles Triangles	-There are two equal-length sides. - Angles that face equal sides also have equal angles. - can be acute, obtuse, or right-angled.	**Area**=1/2×Base× Height	If base = 8 cm and height = 5 cm **Area**=1/2×8×5 cm
Scalene Triangle	-No side is equal - It can be an acute, obtuse, or right-angled triangle	$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$	- If sides are 7 cm, 8 cm, and 9 cm $\text{Area} = \sqrt{12(12-7)(12-8)(12-9)} = \sqrt{720} \approx 26.83\ \text{cm}^2$
Equilateral Triangle	The length of the three sides is the same. - Every angle is sixty degrees. - Three axes of symmetry provide symmetry.	$\text{Area} = \frac{\sqrt{3}}{4} \times \text{side}^2$	- If side = 6 cm $\text{Area} = \frac{\sqrt{3}}{4} \times 6^2 \approx 15.59\ \text{cm}^2$

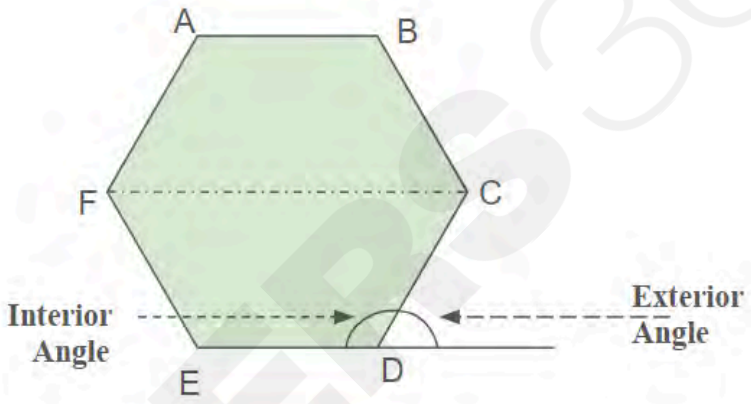
4. POLYGONS

The term "polygon" is derived from the word '**poly**' meaning '**many**' and '**gon**' meaning '**Angle**'.

Polygons are defined as two-dimensional closed shapes formed by joining three or more line segments with each other. We encounter polygons mostly while we learn about geometry. In this lesson, we will learn about polygons' definitions, regular polygons, polygon sides, and the properties of polygons, along with polygon examples and their identification.

Properties of a Polygon

1. It is composed of three or more sides.
2. The polygon's angles might or might not be equal.
3. A polygon's sides could all be the same length or different.
4. It is a planar shape, meaning that it is composed of straight lines or line segments.
5. It is a two-dimensional figure, meaning its length and breadth are its only two dimensions. It has no height or depth.
6. A polygon is a closed shape; it does not have any open ends. It starts and finishes at the exact location.



In this case a **Regular Hexagon**

- The diagonal is FC.
- Every inner angle is equal.
- Every external angle is equal.
- The hexagon's vertices are A, B, C, D, E, and F.
- This regular hexagon has equal sides, which are as follows:
  AB = BC = CD = DE = EF = FA.

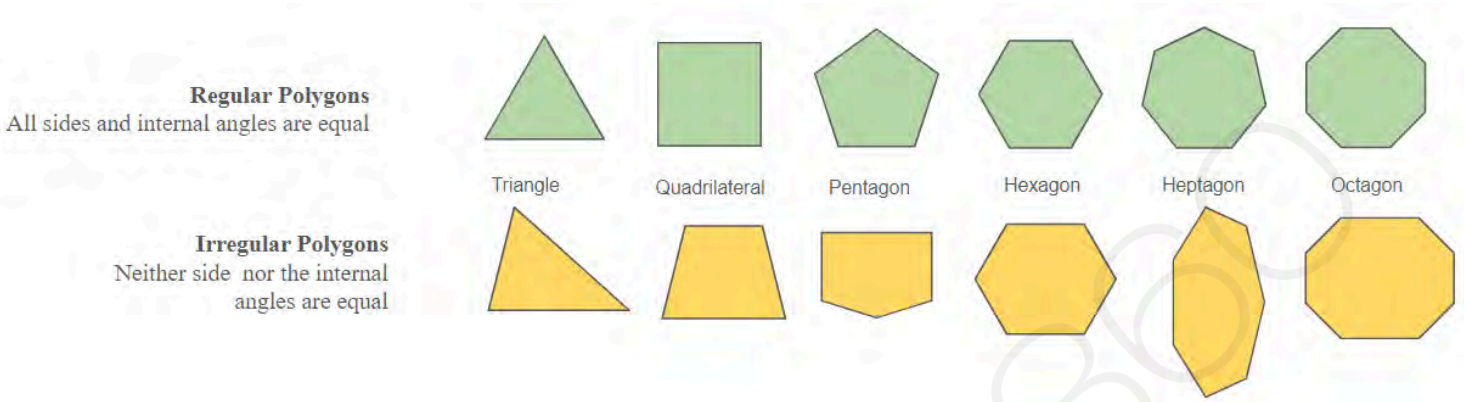
Types of Polygons

There is a range of polygons based on the number of sides from a minimum of 3 sides(**Triangle**) to even up to 20 (**Icosagon**)

Based on the length of its sides and the measurement of its angles, a polygon can be classified as either regular or irregular.

A polygon fulfilling all the below conditions is called **a Regular** polygon when :

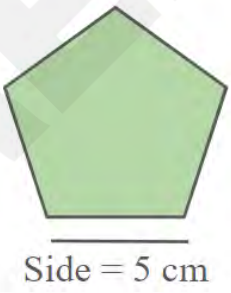
a. The length of all sides is equal.
b. Measurement of all interior angles is equal
c. Measurement of all the exterior angles is equal as well.



Perimeter of a Polygon

A polygon's perimeter is its entire boundary measured from end to end. Since polygons are closed-plane shapes, their perimeters fall inside two-dimensional planes.

Q: **Calculate the Perimeter of a Regular Pentagon for a side light of 5 cm.**



A: Since it's a regular pentagon, all the sides are equal
Perimeter = Sum of All sides
Perimeter = 5 X (5)

Area of a Polygon

The area of a Polygon is the region or space occupied inside a polygon.

A polygon can be classified a**s regular or irregular, depending on how long its sides are**. Therefore, there is a discrepancy in the area of polygons calculated due to this differentiation. The following are some well-known polygons' areas:

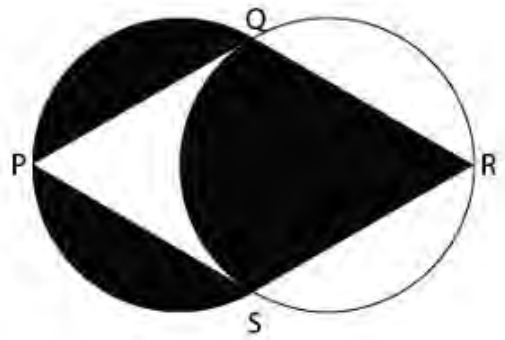
Area and Perimeter for Regular Polygons
All sides and internal angles are equal

Shape	Area Formula	Perimeter Formula
Pentagon	$\text{Area} = \frac{1}{4} \times \sqrt{5(5+2\sqrt{5})} \times \text{side}^2$	$\text{Perimeter} = 5 \times \text{side}$
Hexagon	$\text{Area} = \frac{3\sqrt{3}}{2} \times \text{side}^2$	$\text{Perimeter} = 6 \times \text{side}$
Heptagon	$\text{Area} = \frac{7}{4} \times \text{side}^2 \times \cot\left(\frac{\pi}{7}\right)$	$\text{Perimeter} = 7 \times \text{side}$
Octagon	$\text{Area} = 2 \times (1+\sqrt{2}) \times \text{side}^2$	$\text{Perimeter} = 8 \times \text{side}$

Note: The questions asked in the Design aptitude examination may not ask you to calculate the area of a given figure directly, but mostly the questions asked are application-based.

Sample Question From Previous Year Exams: UCEED/NID- DAT

If SQ = QR = RS = SP = PQ and PR = 21 units, what is the area of the BLACK portion?
(Assume π= 22/7)



Fundamentals of Geometry for 3D Volumes

Introduction

Aspiring designers must have a solid understanding of area and volume. Knowledge of the volumes is critical in form analysis, spatial perception, and problem-solving skills. This essential skill aids the ability to visualise and deal with 3D objects, making it relevant to the DAT ability test. The students who understand these concepts will provide a good foundation for making good fortunes in the design field. As for the perceptual value of the given 3D forms, it is helpful to solve critical questions from the NAT section, which contains relatively easy questions to score.

3D Shapes and Their Properties

a. Cube & Cuboid:

Three-dimensional shapes that come under the class of polyhedra are stable solid bodies with flat faces. There are two crucial shapes known as the cube and the cuboid. These two shapes are identical in that they possess twelve edges, six faces and eight vertices; nevertheless, they are entirely dissimilar in size and shape.

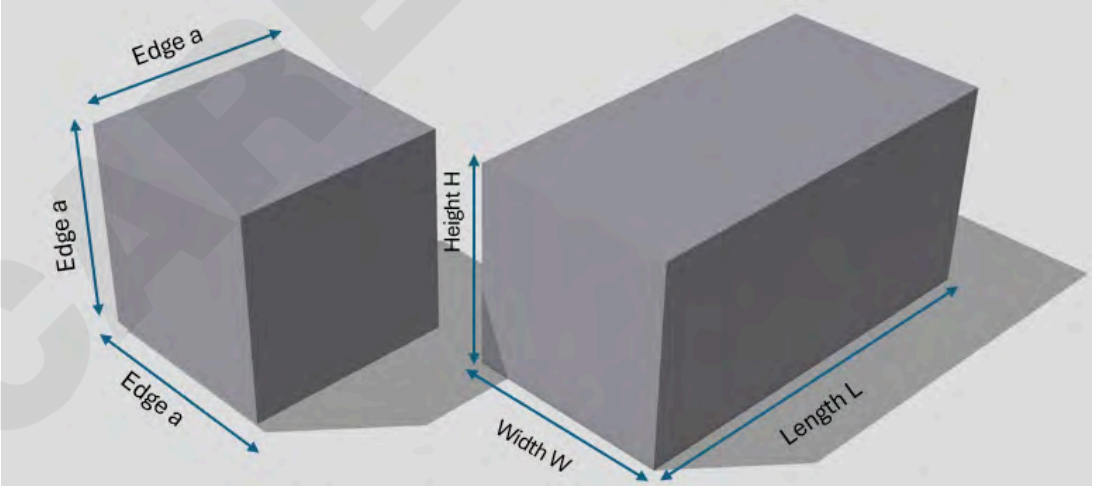


Illustration of Cube, Cuboid with the given **Dimensions**

Comparison of Cube and Cuboid

Property	Cube	Cuboid
Shape	All six faces are squares.	All six faces are rectangles.
Edges	All 12 edges are of equal length.	Edges can have three different lengths: length (l), width (w), and height (h).
Vertices	8 vertices	8 vertices
Faces	6 identical square faces	6 rectangular faces, opposite faces are equal.
Surface Area	$6 \times (\text{edge length})^2$	$2 \times (lw + lh + wh)$
Volume	$(\text{edge length})^3$	$l \times w \times h$

Note: All sides of the cube are equal, and the **length taken is "a" units.**

Similarly, for the **cuboid, Length (l units), Breadth (b units) and Height (h units)**

b. Sphere and Hemisphere

Rounded solids include both hemispheres and spheres, which are three-dimensional shapes. They possess unique mathematical qualities and are frequently encountered in organic forms.

Sphere

A sphere is a three-dimensional object that is precisely spherical and has equal distances between each point on its surface and the centre. It has no edges or vertices and is the three-dimensional equivalent of a circle.

The radius(r) is the length of time separating any surface point from the centre.

For a Sphere

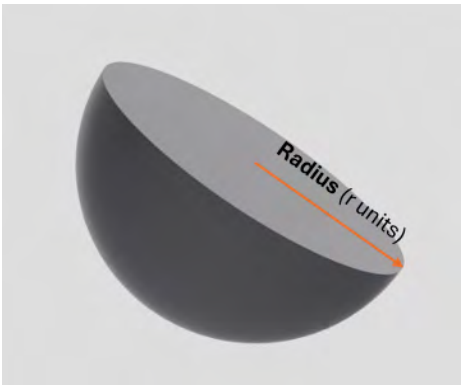
Curved Surface Area: $4\pi r^2$, where r is the radius.

Volume: $\frac{4}{3}\pi r^3$.

Note: All points on the surface are equidistant from the centre in a sphere.

Hemisphere

When a given sphere is cut along its diameter to reveal a hemisphere, which is precisely half of a sphere, its surface is curved, and its base is a flat circular face. Unlike a sphere, it has a boundary running along its circular base but no edges or vertices on its curved surface.



For a Hemi-Sphere

Curved Surface Area: $4\pi r^2$, where r is the radius.

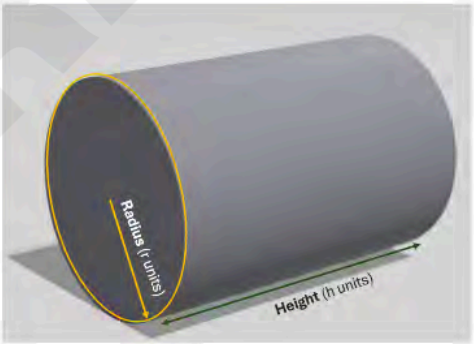
Volume: $\frac{4}{3}\pi r^3$.

- Volume: $\frac{2}{3}\pi r^3$.

Note: A hemisphere with a flat surface is made by cutting a sphere from the centre.

c. Cylinder

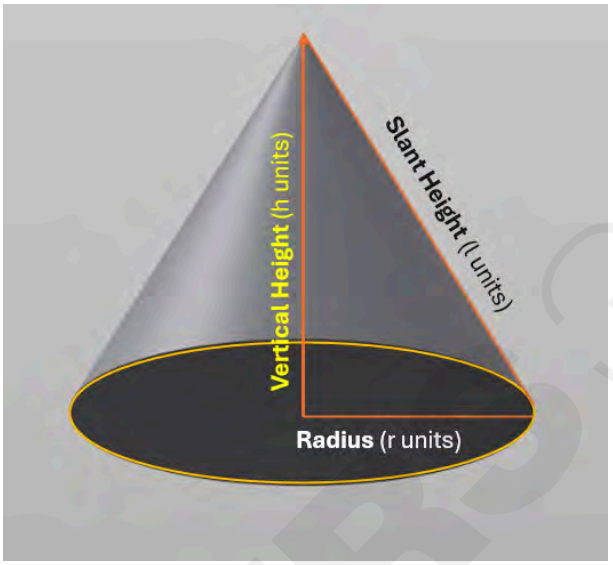
A three-dimensional geometric object called a cylinder comprises two parallel circular bases joined by a curved surface. One of the most prevalent geometric shapes, it can be found in many natural and artificial artefacts. The height in a cylinder is the vertical distance between two faces of the cylinder.



- Lateral Surface Area:
  - The area of the curved surface: $2\pi rh$.
- Total Surface Area:
  - The sum of the lateral surface area and the area of the two circular bases: $2\pi r(h + r)$.
- Volume:
  - The space enclosed within the cylinder: $\pi r^2 h$.

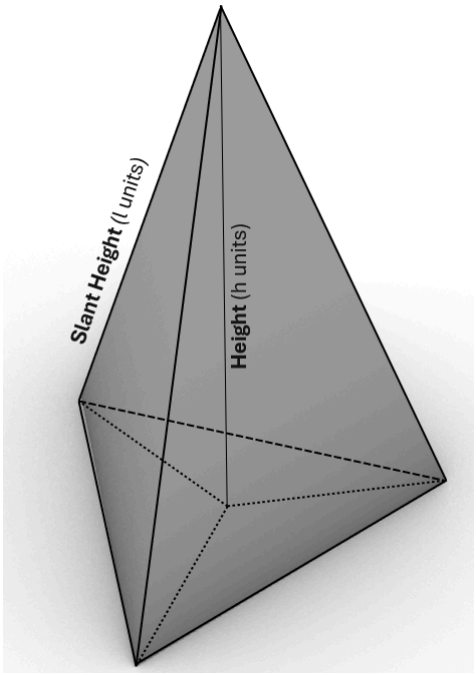
d. Cone

A cone is a three-dimensional shape in geometry that narrows smoothly from a flat base (usually circular base) to a point(which forms an axis to the centre of the base) called the apex or vertex. Cones are frequently visible in man-made and natural forms, such as volcanic mountains, ice cream cones etc.



For a cone with a **height (h units), slant height (l) and base radius (r units)**

- Curved Surface Area:
  - The area of the curved surface excluding the base: πrl.
- Total Surface Area:
  - The sum of the curved surface area and the area of the base: $\pi r(l + r)$.
- Volume:
  - The space enclosed within the cone: $\frac{1}{3}\pi r^2 h$.



e. Pyramid

A pyramid is a three-dimensional geometric form consisting of triangular faces that converge at a single point known as the apex or vertex and a polygonal base. The name of a pyramid is determined by the type of base, like a triangular, square or a based pyramid.

In a pyramid with a **triangular base**, for the given height (h), slant height (l) and having a triangular base, the area can be calculated as follows:

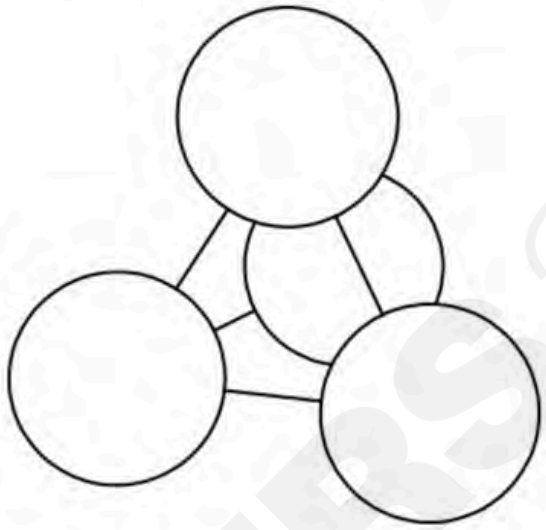
Pyramid: With a Triangular Base(3 sided base)

Surface Area and Volume

- Lateral Surface Area:
  - The sum of the areas of the triangular faces: $\frac{1}{2} \times \text{Perimeter of the base} \times \text{Slant height}$.
- Total Surface Area:
  - The sum of the lateral surface area and the area of the base: $\text{Lateral Surface Area} + \text{Area of the base}$.
- Volume:
  - The space enclosed within the pyramid: $\frac{1}{3} \times \text{Area of the base} \times \text{Height}$.

Sample Question Paper: UCEED 2024

Shown below is a configuration of FOUR solid spheres each of radius 40cm that are placed on four corners of a regular tetrahedron with side 120cm. The centres of the spheres coincide with the corners of the tetrahedron. What is the radius (in cm) of the largest sphere that can be accommodated within the tetrahedron?



Animation Principles and Applications

Introduction

There are twelve principles of animations which are very crucial for the NID aspirants. These principles introduce into designs such wonderful feature as activity and passion. These concepts do not only improve the skills in animation, but also in the overall design, or at least, give more flexibility on a design. You will be able to design better and more eye-catching pieces for your NID entrance exam to convey both motion and emotions.

Of course, you are wondering, What are those 12 Principles of Animation?

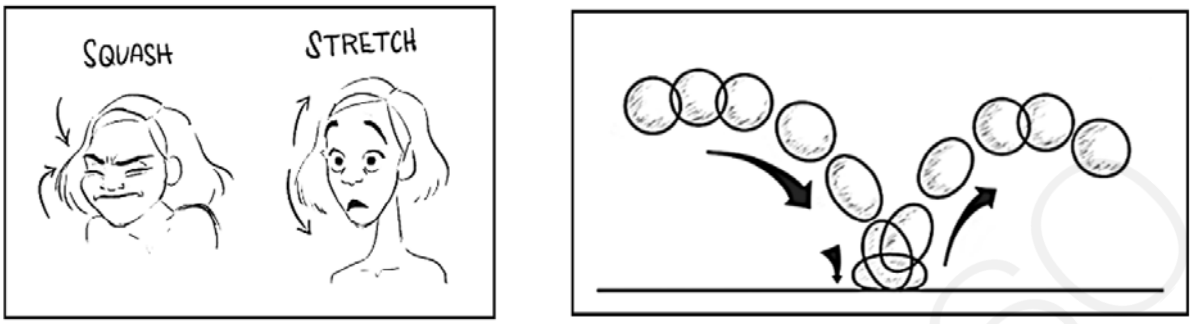
1. **Squash and Stretch**
2. **Anticipation**
3. **Staging**
4. **Straight Ahead Action and Pose to Pose**
5. **Follow Through and Overlapping Action**
6. **Slow In and Slow Out**
7. **Arcs**
8. **Secondary Action**
9. **Timing**
10. **Exaggeration**
11. **Solid Drawing**
12. **Appeal**

That's why let's learn and understand these!

1. **Squash and Stretch** – This principle provides a three-dimensional feature of a character or object while in motion. It is used to amplify the distortion of the object under its dynamic state.

   Application: Applied in character animation to demonstrate instances of their mood or when touched and their ability to bend. For example, character's face when it is drawn with the concept of becoming squashed or stretched when emotive adds an extra layer of value.

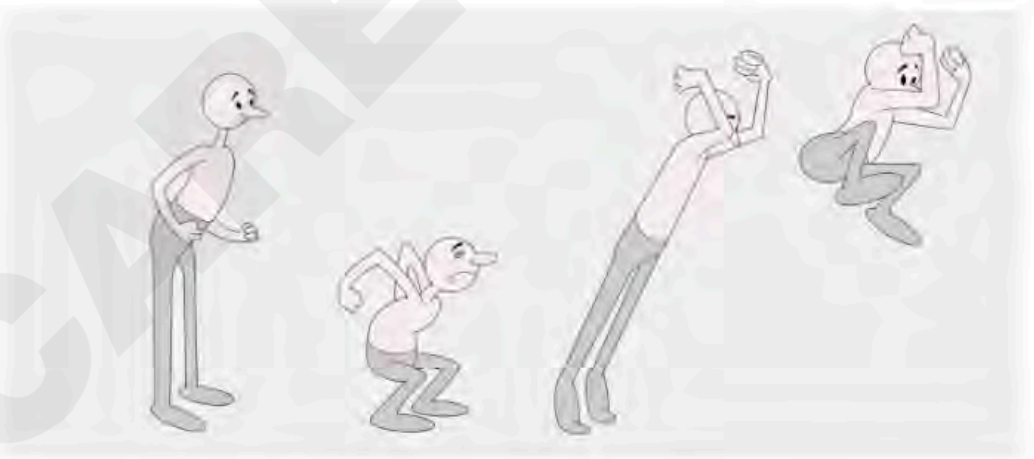
For easier understanding let's consider an example of when a ball has fallen and bounced on the ground :



The bouncing of a ball is a perfect example of how a ball compresses (Squash) when it hits the ground and elongates (stretches) in the air.

2. **Anticipation -** Anticipation gets the audience ready for an action that a character is going to take, and hence makes the action look more believable. As far as the body posture is concerned we assume that this is next. To better illustrate this concept let us look at an example where a specific character looks like he jumps in the next frame.

   Application: Helps to make movements in an upcoming action easier by cueing the viewer lifelike and engaging.



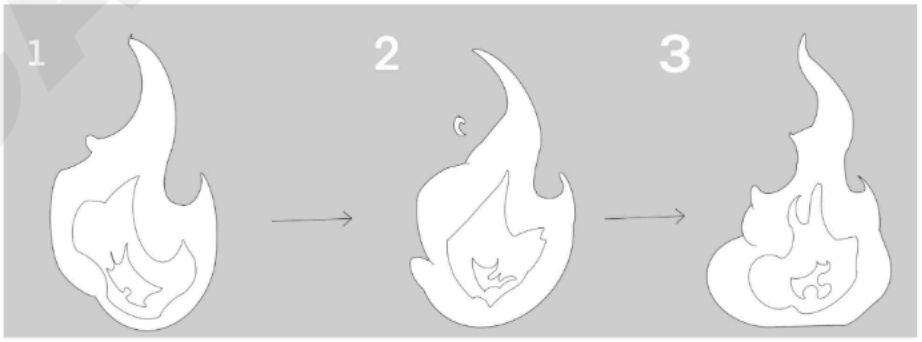
We can anticipate the characters bending their knees before jumping, which is close to real-life action.

3. **Staging -** This shifts the focus of the audience to an area in the stage that contains the most important information regarding a particular scene and the action taken.

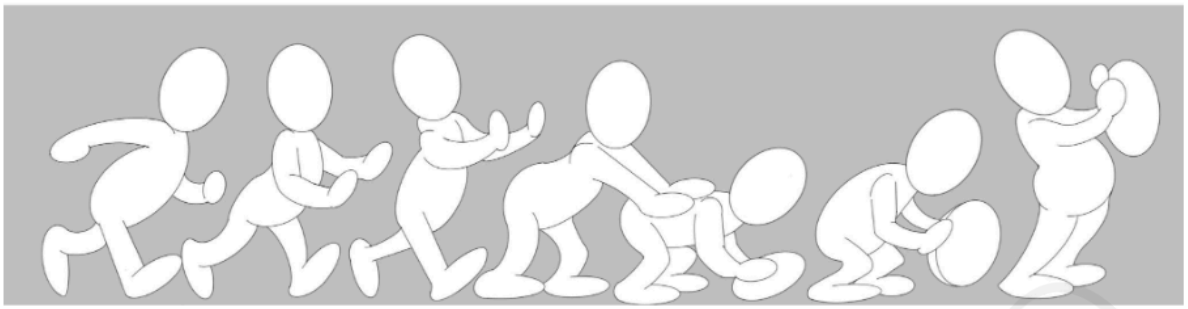
   Application: Show where in the scene is most important while telling the story so that the viewer can understand the scene.

Using lighting, camera angles, and character positioning to emphasise a critical moment in the story.

4. Straight Ahead Action and Pose to Pose - They are two different actions of making animation. Straight ahead action implies development of some frames right from the initial stages to the final stages while pose to pose means that you first draw some poses and later join the spaces in between them.



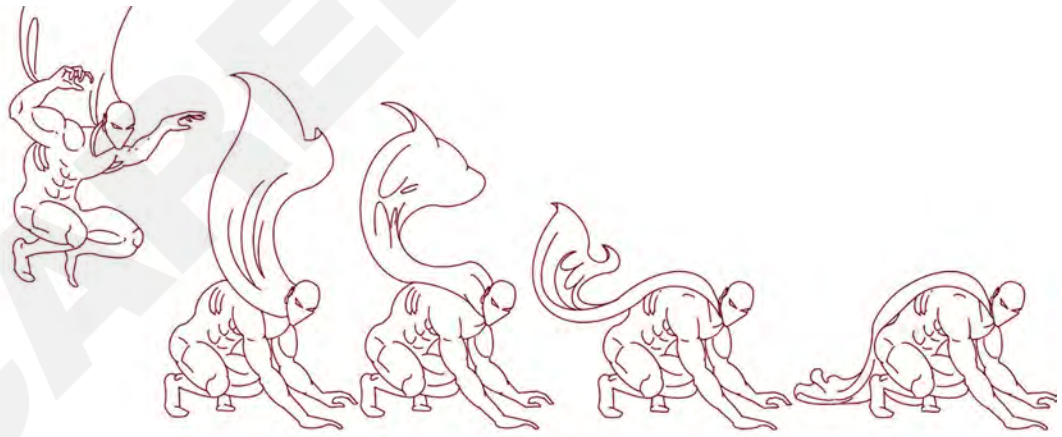
Straight Action Technique : Useful to depict the fluid and unpredictable actions like fire



Pose to Pose is used for more controlled movements like a character's Walk Cycle

5. Follow Through and Overlapping Action - This principle aids in making the motion looks more natural by presenting that different parts of a character or an object move distinct speeds. In literary studies it is often used in the sense of motion: follow-through is the limbs that keep going even if the main part of the body has stopped moving. Overlapping Action is the small time that occurs between the on set of a new action and the desist of the former.

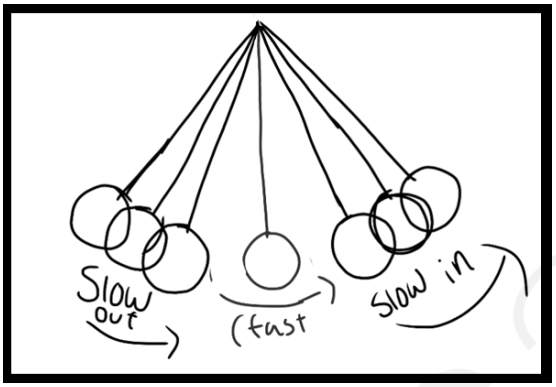
For instance, **when the superhero lands the second frame, one is able to note that his leg is bent at the knee showing the force that was used.**
cape is left behind and it then rejoins through the continuing images. This can be used it was introduced to make the image to look more real.



Application: Adds realism by showing that body parts continue moving after the main motion has stopped.

6. Slow In and Slow Out - This principle ensure that the motion is natural as more frames are applied at the starting and ending of the action.

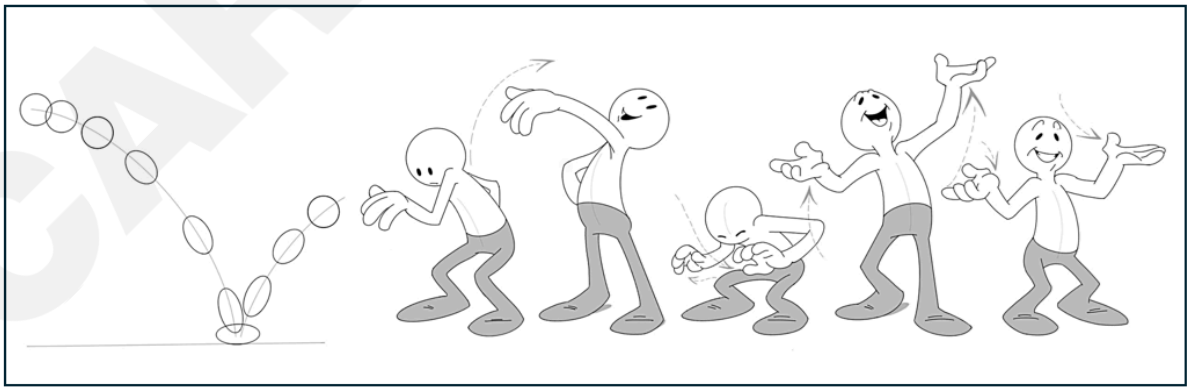
In most motion, there is always that time is left off then increases, reaches its peak before decreasing and then is stopped. Yoga exercise or like that bouncing ball which then hits the other ball or something of the sort swing, or a pendulum). Shown below;



Application: Increases more natural motion by putting more frames at the start and end of a particular action.

7. Arcs - Natural actions are some of the most common shapes found in interactions and usually follow arc characteristics rather than linear ones. This principle is used in making the animation look as if it has actual natural movement. With a very high frame rate camera, it captures a movement.

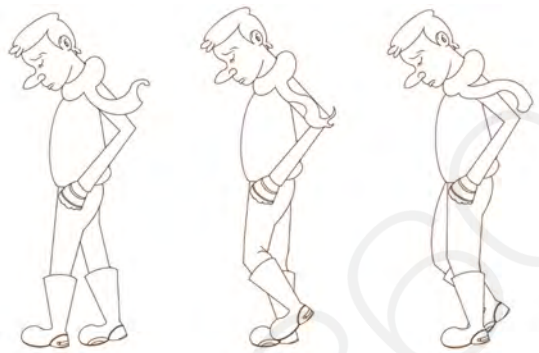
To better explain this let us take an example of a ball bouncing in the motion and the character arms in the movement in throwing and catching it.



Application : Used to produce modelled and effortless motion as most human as well as animal structures. actions follow an arc.

8. Secondary Action - These are the actions that compliment or extend the primary action to give depth to the scene.

For example, a person walking is the primary one or the reader and the writer.

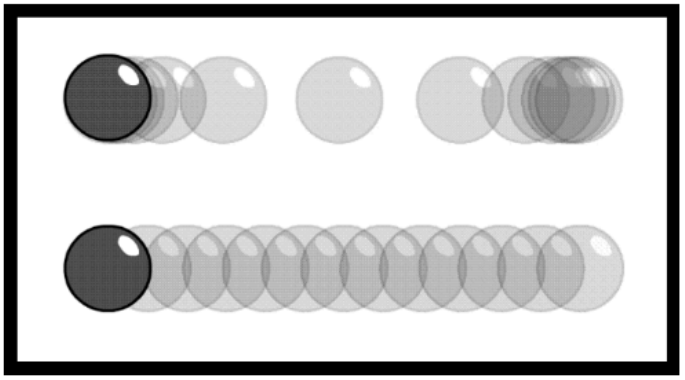


- Having factors such as his muffler waving as the second action increases the mood of the scene, to make Chalk & Cheese appear more breezy and to narrate the feelings of the character.

Application: Further enhances the primary function of the scenes, enriches the perception and makes everything more interesting.

9. Timing - The time allocated to produce an action where the number of frames given defines the speed of the movement.

An effortless thing to remember: A fast, snappy movement will have fewer frames than the slow, sluggish one more than a slow, deliberate action including an objective to be realised at some other point of time.



In the above figure the number of frames and spacing gives the feeling of how the fast and slow movement will be.

Application: Influences the speed, weight and even mood of the driver. Timing makes the animations to be more lively or soothing as it is supposed to.

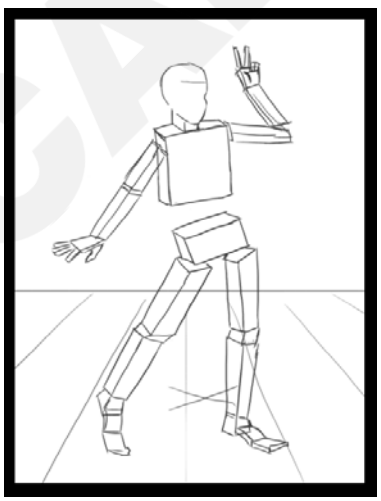
10. Exaggeration - This principle entails making actions big and juicy but realistic at the same time..

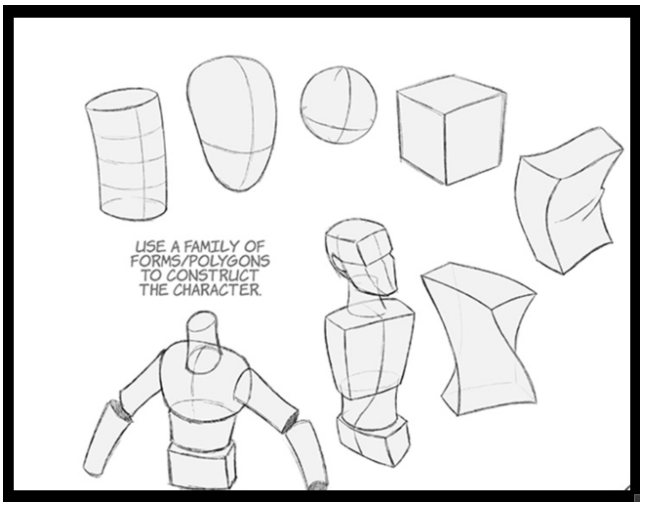
For instance, for expression of emotions, the movements of a character are overdone as seen below.

Here, the young girl's gesturing of body language including popped out eyes and wanting to open mouth introduces, emotional state that can be expressed as 'being shocked', 'surprised'.

Application: It provides reinforcements to emotions and other actions performed by people to make them more powerful and easily memorable.

11. Solid Drawing - Something like lighting guarantees that forms appear immeasurable and real as if in the three-dimensional plane possessing volume as well as mass.





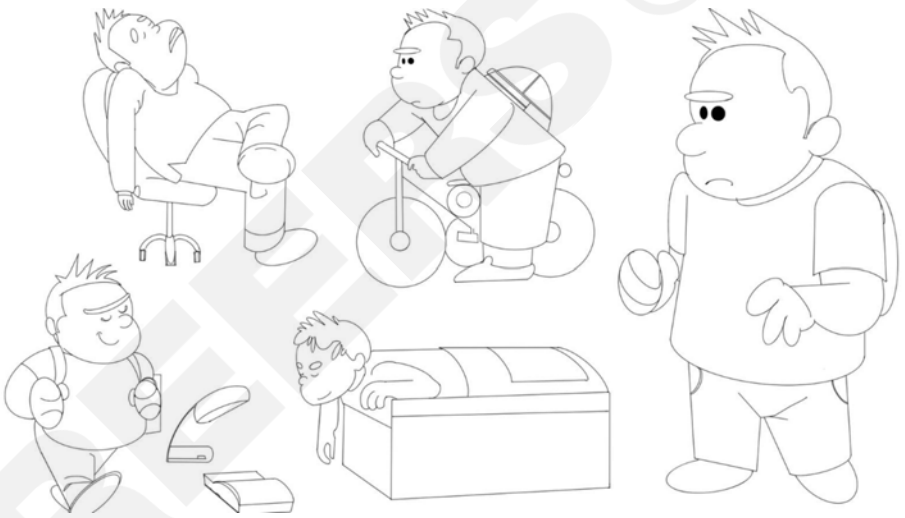
That is likened to drawing in a box so as to confine it and give it a particular capacity rather than making it flat.

Application: Makes characters and objects appear natural and realistic and This makes characters and objects to be real.

12. Appeal - Appeal is all about making characters and animations to be charming and interesting and making characters with special and rather outlined features and temperaments.

The character here seems lethargic and being not good in studies while being good at sports. For the simple inferences, they are made.

- **Application:** Developing interesting and appealing personalities, to match the target audience.



Activities: For Learning by Doing

Activity 01 - Bouncing Ball Exercise

- **Objective**: Having knowledge about the principles such as squash and stretch, the principle of timing and arcs.
- **Procedure**:
    1. Draw a simple ball.
    2. Add life to the ball bouncing so that the ball looks as if it is inflating as soon as it leaves the ground and deflating each time it impacts the ground.

3. Emphasise timing by making the ball slow down at the top of arc and gain speed as it is falling.

- **Outcome:** This activity makes students more aware of the aspects of exaggeration and natural moves to be incorporated in animation.

Activity 02 - Applying principles of anticipation, follow-through, and overlapping action.

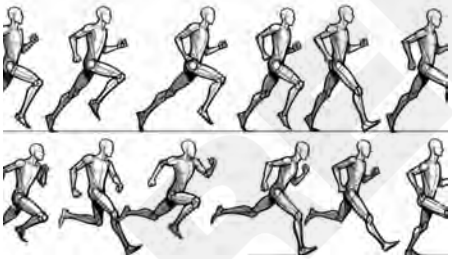
Procedure:

1. They need to come up with a simple character sketch at least.
2. Break down the walk cycle into keyframes: concerning contact, recoil, passing, and high point.
3. Exaggerate the walk so that you can see how the character prepares for the next step and how the various part of the body respond and overlap in that process.

Outcome: The procedures of actions and characters would be natural since the students pay attention to the basic principles of animation.

Sample Question: How are Walk & Run Cycles critical for Animation?

The run and Walk Cycles facilitate the following.



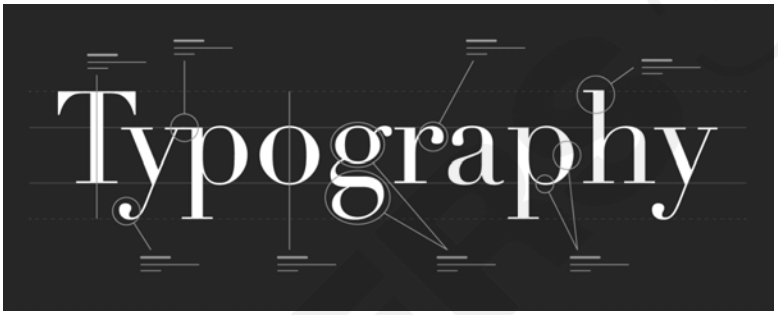
- **Timing and Spacing:** Very important for the proper and natural appearance of the walk at a realistic pace.
- **Arcs:** It also important to maintain natural movement of the limbs.
- **Squash and Stretch:** Improves the liveliness while doing foot impacts as well as the overall body movement.

Run Cycles:

- **Exaggeration:** One should express the speed and vigor of a run.
- **Anticipation:** Warns the viewers for the next step which makes the action even more complex.
- **Follow-through and Overlapping Action:** Looks more realistic and adds weight or at least the feeling of it especially to hair and characters cloths.

Typography

Typography means the application of arts and techniques in arranging type for enhanced aesthetic and readability values of textual information. It is vital in the process of designing because it determines how the contents are viewed and, in turn, comprehended. For instance, the use of different forms of headline typeface is daring and trendy, while the use of the more straightforward typeface for the text body provides simplicity and legibility, respectively. Thus, it becomes crucial for the contender of NID and UCEED to learn about it as it is the building block of any concept in visual language and design.



Elements of Typography

There are 06 elements of Typography which are covered in this article.

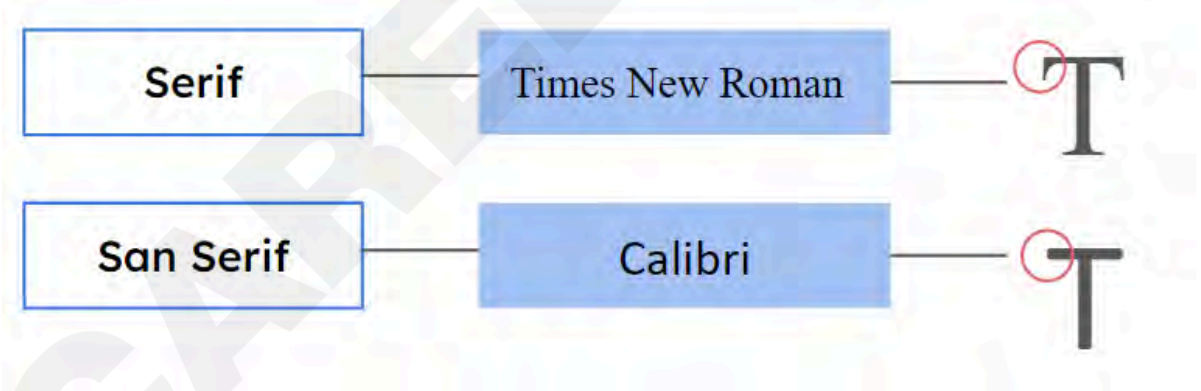
1. **Typeface**
2. **Hierarchy**
3. **Alignment**
4. **Spacing**
5. **Contrast**
6. **Legibility**

Now let's try to understand each of them isolated through examples in illustrations.

1. Typefaces and Fonts: They are the mode and manner of the write up. A typeface can be defined as an overall look and feel of a set of letters, numbers, and symbols, while a font is simply a sub-category within a typeface for instance, **bold** and *italic*.

Classification of Typeface: Serif Vs. Sans-Serif

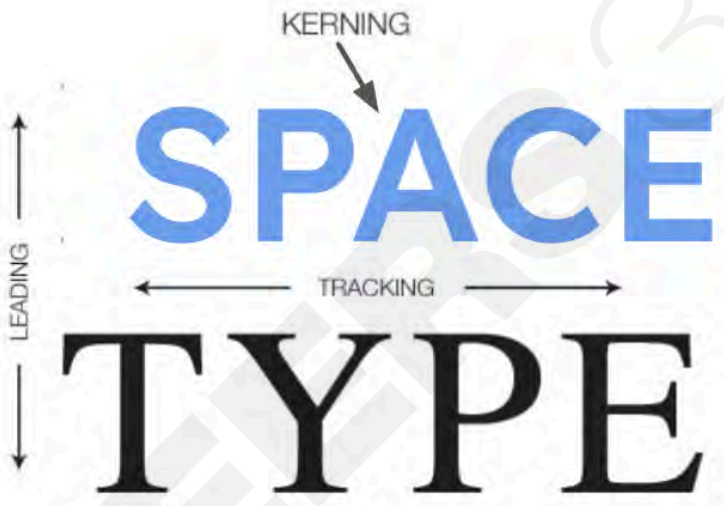
Feature	Serif Font	Sans Serif Font
Appearance	Classic, formal, with decorative strokes	Modern, clean, with uniform strokes
Readability	It is easier to read in print, especially for long texts	Better for digital screens and short texts
Emotional Tone	Conveys tradition and reliability	Conveys modernity and simplicity
Common Usage	Books, newspapers, and formal documents	Websites, apps, and logos



2. Hierarchy: Text formatting to prioritize, that is the strategic placement of numbers, letters or words in order to control the viewers focus.

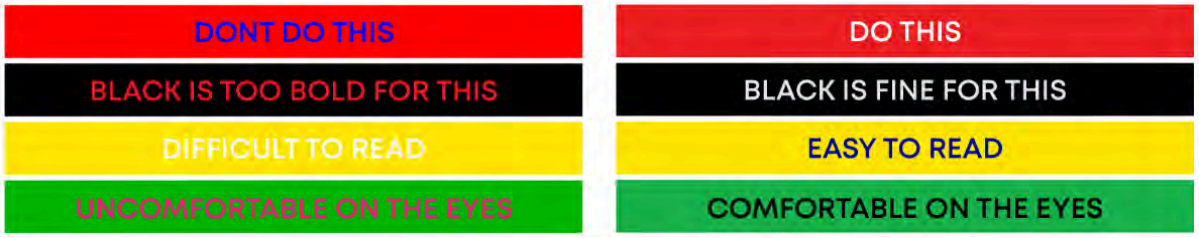
3. Alignment: It enhances the general aesthetics of design, guides the reader's eye, and facilitates readability. For instance writing tend to be aligned to the left to ease reading while text aligned to the centre is more formal for invitations and titles. These he found relate to the clarity and the tone of the design, where a certain degree of alignment decisions prevail.

4. Spacing: The following aspects of Typography are related to spacing which we would understand with the example shared :The following aspects of Typography are related to spacing which we would understand with the example shared :



4a. **Leading:** It is usually the space that lies between two lines of a text body.
4b. **Kerning:** The distance that exists between two individual character in a word.
4c. **Tracking:** It is the spacing of every letter in a single word or in the entire passage for a particular text.

5. Contrast: Typography should have contrast in-order to enhance readability as well as add element of aesthetic appeal to texts. It involves the use of contrasting features referring to headings and the actual body text in form of typeface, size, weight and color.



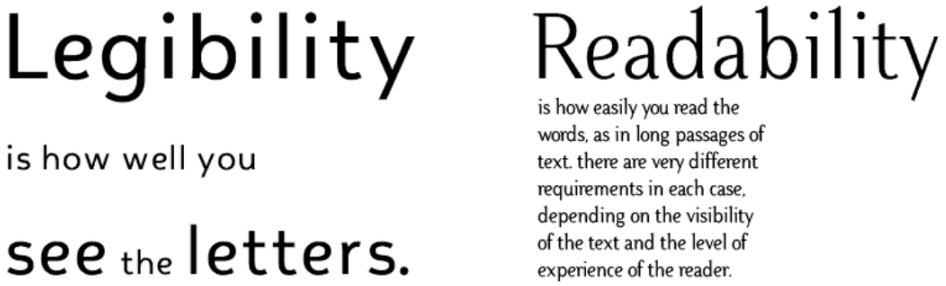
Using Colours Create Impact

6. Colour: Typography needs colour to increase reading and add visual interest. It means utilising different complementary colours to distinguish parts such as headings and body text. A text with good colour theme is easier to read, helps the reader concentrate, and draws attention to key points.

7. Legibility and Readability:

7a. Legibility is the ability to discern particular letters or characters from one another easily. It depends on things like font selection, size, and spacing. High readability is required for writing that needs to be rapidly and adequately recognised, such as headlines, logos, and signage, where instantaneous clarity is critical.

7b. Readability is the level of understanding a reader can manage to go through a particular text passage without difficulty. It depends with the general layouting which factors include line length, line spacing and the size of the font. A high level of readability is especially critical with more significant works, for example, books and journals where the way information is written must help the reader to follow it easily.



Typography for Good Design

Good typography is essential because it helps to produce better communication great and clear-looking materials. It can guarantee that the message has been passed in the right manner, control the flow of attention and elicit the most appropriate emotions. Typography is considered to be an important field for a design aspirant because it is the base of every type of visual communication. When designing logos, websites, or any other print media, the professional must effectively balance the use of good typefaces, thus making the designs more effective to the Target group.

In such examinations as NID and UCEED, typography distinguishes one's work to the other and this is where a candidate can triumph forever with good typography. It would also show details, creativeness and a good understanding of type that affects designing.

Diverse Applications of Typography

1. Web Design: Typography helps to increase website usability and branding as it controls the flow of users' interactions and ensures the overall consistency of a visual design.

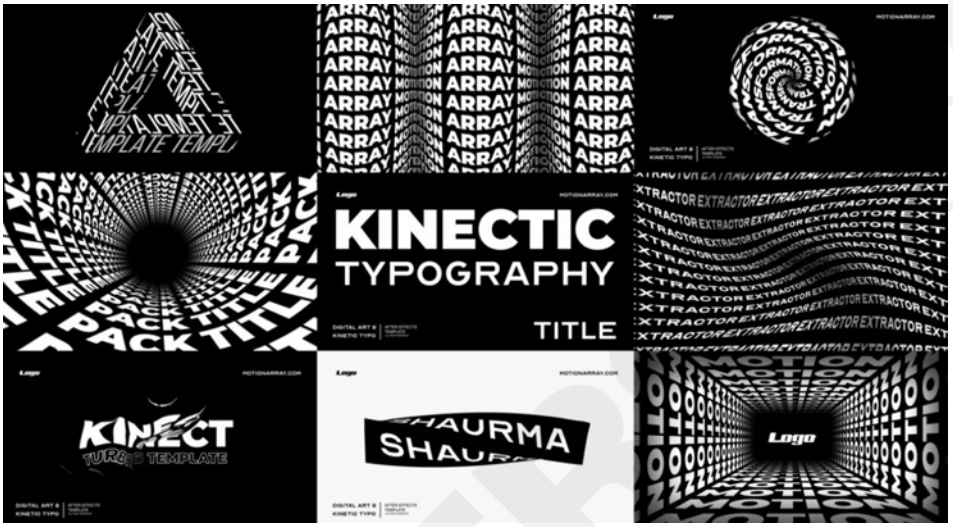
2. Mobile Application Development:

- **User Experience:** An intuitive and pleasurable app is created by carefully selected typography, which also improves readability and user engagement.
- **Brand Identity:** The personality of the app is communicated and brand identification is strengthened through consistent typography.
- **Accessibility:** Content that is properly typeset is guaranteed to be readable by all users, including those who are visually impaired.
- **Visual Hierarchy:** The app's navigation is enhanced and users are guided through it by the effective use of typography, which also highlights key information.
- **Space Management:** Text size and readability can be balanced by optimising screen space with an understanding of typography.

3. Print Design: Excellent reading flow and aesthetics are critical in design such as editorial and packaging and thus the need for Typography in print.

4. Branding and Identity: Typography identifies the brand tone and gives cohesiveness to logos, marshall's and commercial graphics.

5. User Interface (UI) Design: Typography labels are used to make the interactive elements and structure the information clearly and easily.



6. Motion Graphics: The use of Typography gives life to the content that is put in a video and determines the mood in the title sequences.

7. Environmental and Spatial Design: Graphic design in signs and exhibition makes it easier to provide ways of getting around as well as making physical spaces more interesting.

Important Sample Questions from NID/UCEED

Q1. Which option has the same visual grammar of the letters on the left?

***Approach - Notice the stroke and line weight at the middle and ends.**

CUBES & DICES

Cubes and dice problems are recurring in many design aptitude tests, including NID and UCEED. These questions test a candidate's spatial visualisation skills, analytical ability, and attention to detail. This article provides a detailed overview of how to approach cubes and dice problems, essential concepts, and tips for solving them effectively.

The questions are asked interchangeably for cubes and dice, where the cubes are treated as dice and vice versa.

Introduction to Cubes and Dice

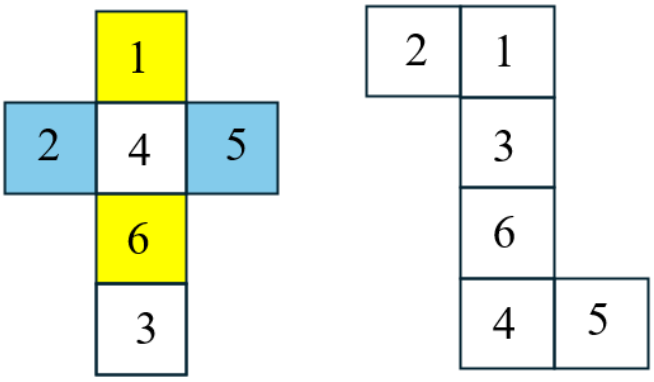
What is a Cube:

- A cube is a three-dimensional geometric shape with six equal square faces, twelve equal edges, and eight vertices.
- All internal angles in a cube are right angles (90 degrees).
- Each cube's edge is of equal length, and the cube is symmetric along its axes.

What is a Dice:

- A die is a type of cube used in various games, typically numbered from 1 to 6.
- Standard dice have opposite faces that add up to 7 (1-6, 2-5, 3-4).
- The numbers are arranged so that no two consecutive numbers are adjacent.

*Fact: **The sum of the opposite side of the cube is seven(07); e.g. the opposite faces 1-6 sum to 7, similarly for the 3-4 & 2-5 pairs of opposite sides.**



Types of Cube and Dice Problems

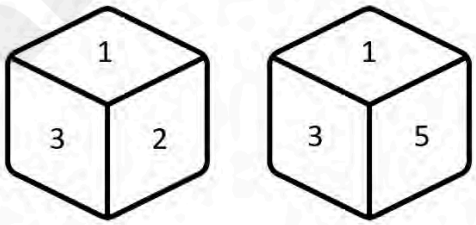
Type 01 : Identification of Opposite Faces:

These problems ask you to identify which faces are opposite in a cube.

Opposite Side sum Rule: For a standard dice it has opposite pairs like (1-6), (2-5), and (3-4) and the sum of the number on the opposite side is seven.

Commonly asked questions focus on Identifying these pairs is crucial for solving related questions.

What number is opposite to 1?

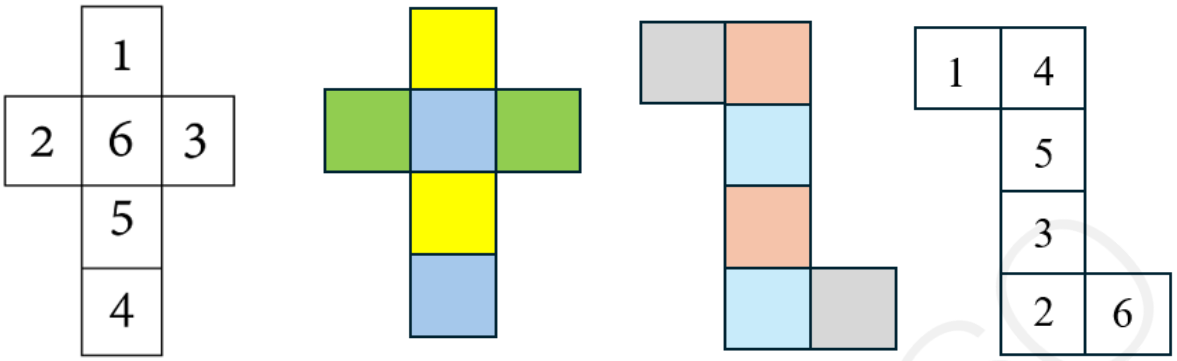


Type 02 : Cube/Dice Folding and Unfolding

These problems require understanding how a 2D net of a cube can be folded into a 3D shape.

Example: Given a net of a cube with numbered faces, determine which numbers will be on opposite faces when the net is folded.

* **Hint**: The alternate faces are always opposite to each other.

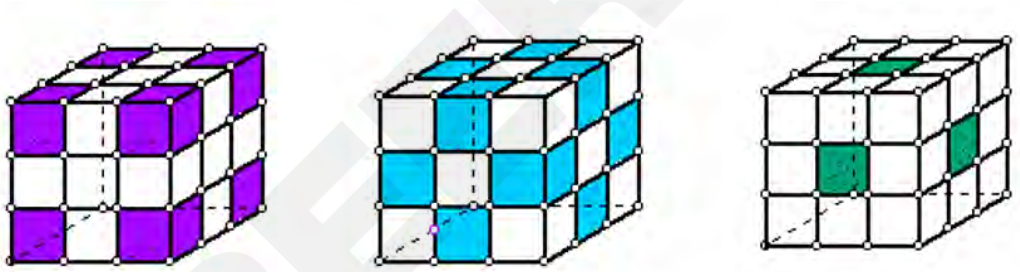


In an arrangement, the alternate boxes are marked by same colours for an unfolded view

Type 03 : Painted or Coloured Cubes

These questions often involve a large cube painted on the outside and then cut into smaller pieces.

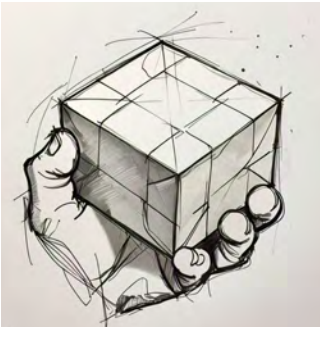
Questions : Identify how many smaller cubes have a specific number of painted faces.



Key Concepts and Techniques for Solving Cubes/Dice Questions

a. Cube Visualisation

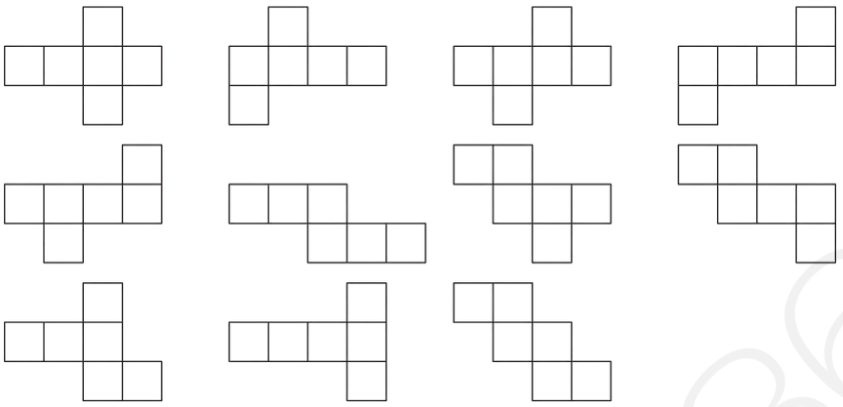
Practise visualising how a cube would look from different perspectives.



Activity : Familiarise yourself with how different patterns and numbers align when a cube is rotated by making the paper cubes, and rotating.

b. Practising Cube Nets

A 2-dimensional pattern or arrangement of squares that may be folded into a 3-dimensional cube is called a cube net. There are 11 possibilities of unfolding a dice/cube as shown below.



It is a flat depiction of a cube's surface that displays all six of its square faces. A geometric shape called a cube net can be used to investigate and comprehend a cube's characteristics, such as its volume and surface area.

Important Attributes of Cube-Nets

- Six squares, one for each face of the cube, make up a cube net.
- To guarantee that the squares can be folded into a cube, they are organised in a particular way.
- There are several conceivable cube net arrangements; for a regular cube (without rotations and reflections), 11 such configurations have been found as shown below.

Tips to approach the Cube/Dice Questions

a. Practice with Nets:

- Regularly practise folding **cube nets** on paper to improve spatial visualisation.
- Memorise standard net configurations to save time during exams.

b. Use Elimination:

- For multiple-choice questions, use the approach of elimination by visualising which options cannot be correct. **Mostly focus on eliminating the wrong choices over finding the right option.**

c. Annotate and Sketch:

- In problems involving painted or large cubes cut into smaller ones, sketching can help track which cubes have painted faces.

d. Count Techniques:

- For painted cube problems, start counting from the corners, edges, and finally, the faces to avoid missing any cubes.

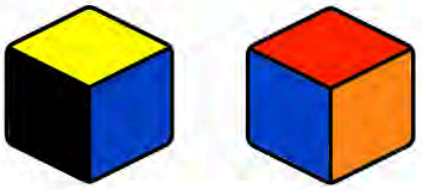
Application of Cube and Dice Concepts in Real-World Design

- Designers utilise three-dimensional thinking to create innovative products, packaging, and architectural structures.
- Visualisation and manipulation of three-dimensional forms help achieve space optimization and aesthetic appeal in product design..
- Efficient packaging solutions: Optimising space and materials by understanding three-dimensional forms.

Practise Questions from the previous year's Exams.

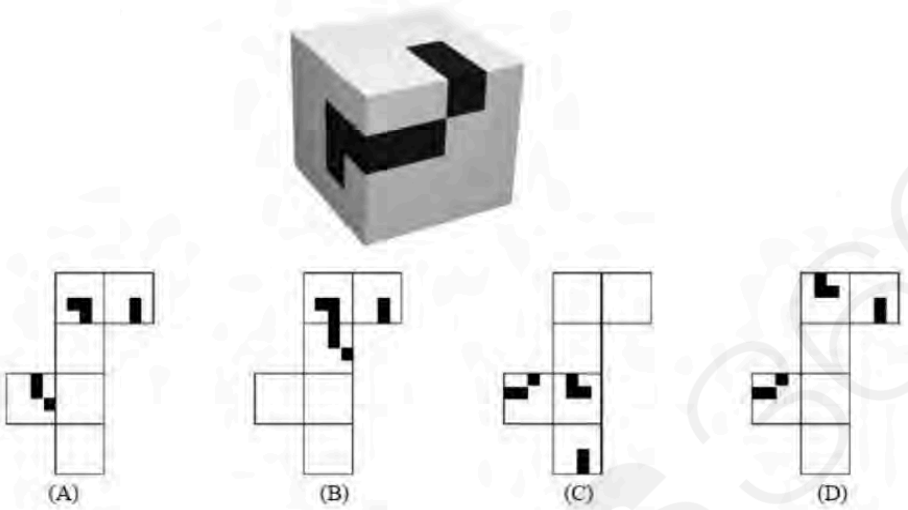
Q1 What is the opposite face of "Red"?

A. Red
B. Blue
C. Yellow
D. Black



***Approach** - Comparing both cubes together and taking out blue as common we can see that yellow is opposite to red.

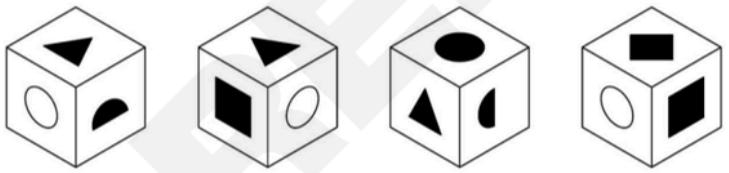
Q2 Which of the paper sets when folded along the intermediate borders can form the cube as given in the image below?



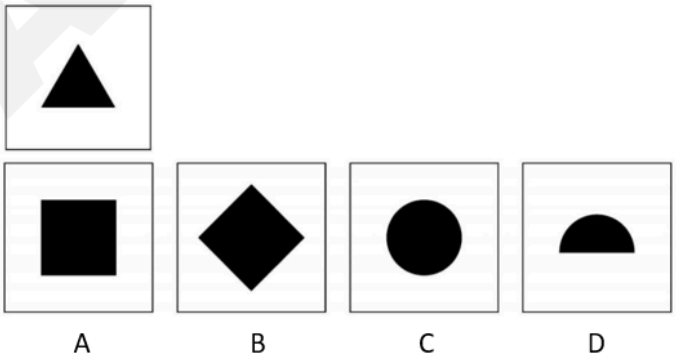
***Approach** - Compare the three folding faces together and match the common shape or figure, We can see that option "B" is the answer.

Important Sample Questions for NID/UCEED

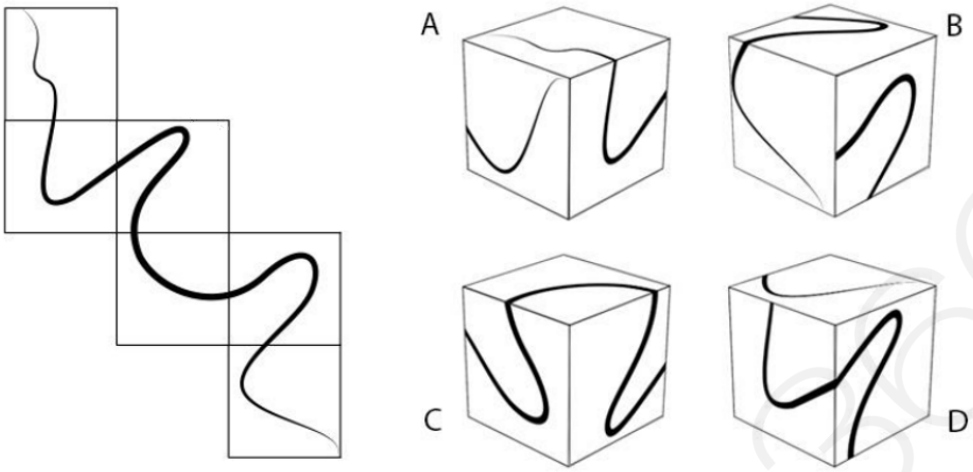
Q1 Depicted below are four various orientations of the same cube:



Select from the options given below, the face which is located opposite to the face depicting the triangle.



Q2 Shown on the left is the development of a cube. Which of the options can be created when the shown development is folded?

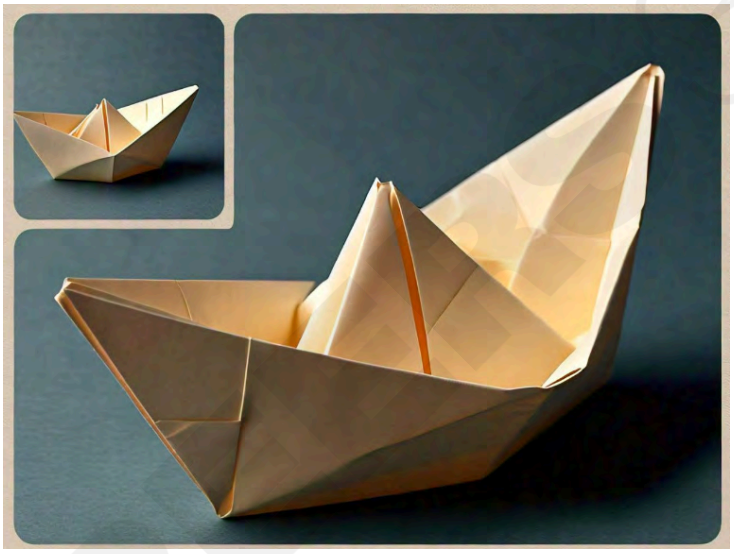


Conclusion

Many times we come across cube and dice problems which can seem to be very tricky but with practice and a good understanding of the basics, the problems are surmountable. These questions are basic spatial orientation and logical problem solving, abilities which are mandatory for any prospective designer. This article helps NID and UCEED aspirants to understand how and what they have to answer while solving the cube and dice questions.

Paper Folding/Unfolding and Cutting

The ability to fold, unfold, and cut paper is essential in design aptitude examinations like the NID (National Institute of Design) and UCEED (Undergraduate Common Entrance Examination for Design). It is one of the most repeated types of questions under the **Non-Verbal Reasoning section**, where questions are asked under two categories, as further elaborated in this study material**.** These tasks evaluate your accuracy, inventiveness, and spatial visualisation. This article explains the methods, approaches, and tactics for developing these abilities so you can do well on exams.



Simple Paper Folding Exercise: Making a Boat

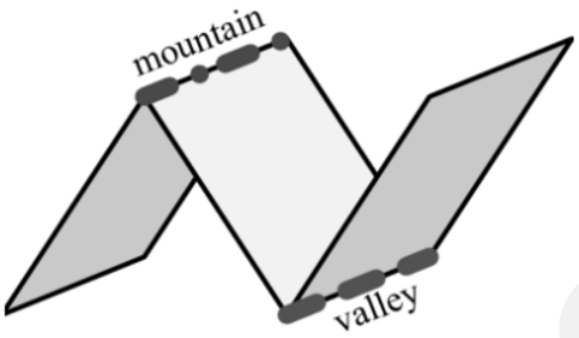
The Importance of Paper Folding and Cutting in Design Aptitude Tests

- **Spatial Visualization:** These exercises help you visualise how a 2D sheet of paper can transform into a 3D object, enhancing your ability to understand and manipulate space.
- **Problem-Solving Skills:** Creating specific shapes or designs requires creative thinking and problem-solving, which are critical for innovative design solutions.
- **Understanding Structural Integrity**: Paper folding and cutting teach you how different shapes and structures can be created and how they maintain stability and balance. This understanding is crucial for designing functional and aesthetically pleasing objects.

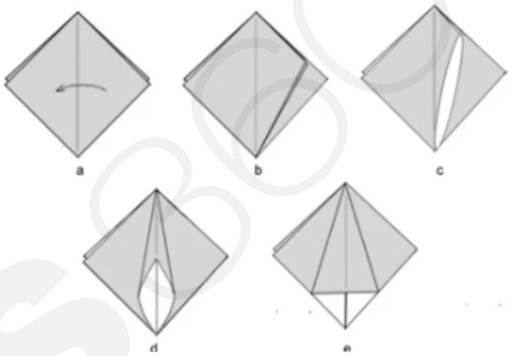
Introduction to Folding Exercises

1. **Fundamental Fold Making**

   Start with basic folds like valley, mountain, and squash folds. Mastery of these basics is essential for more complex designs.



Mountain fold and Valley fold



Squash fold

- **Valley Fold**: Fold the paper towards you, creating a "V" shape.
- **Mountain Fold**: Fold the paper away from you, to form a mountain-like shape
- **Squash Fold**: Open a fold and press it flat to create a new shape.

2. Shaping and Structuring Traditional Arts

2a. Origami: The Japanese art of paper folding is excellent for practising complex folds. Start with simple designs like cranes or boxes and gradually move to intricate models.

2b. Kirigami: This involves cutting paper to create designs. Practice making pop-up cards or snowflakes to improve your **cutting precision and creativity.**

Illustration by Lama AI : Kirigami Art

2c. Modular Origami: Create multiple units and assemble them into a single structure, helping you understand the relationship between different design parts.

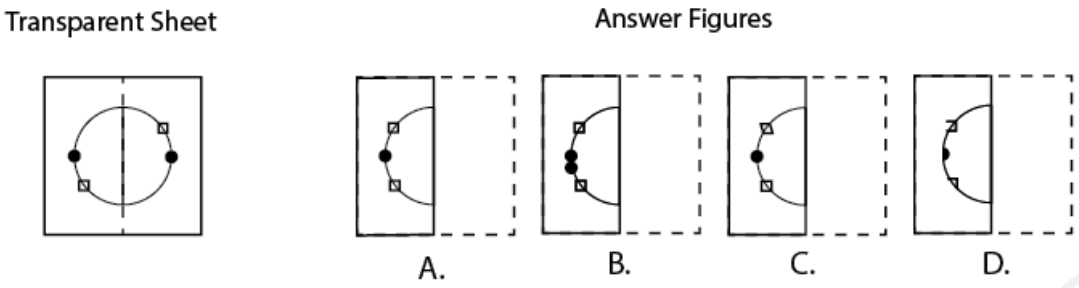
Illustration by Lama AI: Modular Origami

Types of Frequently Asked Questions: NID/UCEED DAT Examinations

There are two types of questions, as discussed below under this topic:

1. **Type A. Paper Folding on a Transparent sheet (Overlapping Exercise)**
   In this type of question, the given transparent sheet is folded along the dotted line as shown and folded in a particular manner.

Let's understand through an example: **A transparent sheet with a pattern is given in the figure below. Figure out from the answer option how the pattern would appear when the sheet is folded along the centre.**



Approach for Solution: As the overlapping of the sheet results in the superimposing of the pattern provided, the most feasible option is A, eliminating all the other options with their respective limitations.

2. **Type B. Paper Folding and Cutting type Question (Visualisation Based)**:

   When a piece of paper is folded in a particular manner and cut in a pattern to guess the pattern, it is mainly asked in questions. Let's understand the same with a step-by-step folding and cutting activity.

Material Required

a. A4 Paper Sheet
b. A pair of Scissors
c. Pen/Marker for Sketching
d. Cutting Board

Step-by-Step Methodology

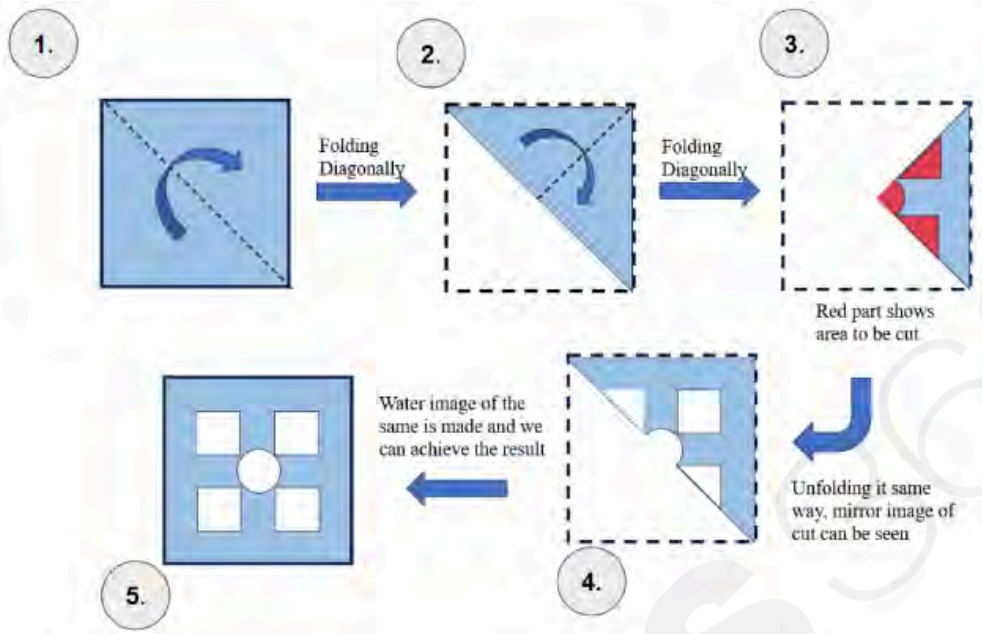
Step 01: First, regular paper is folded diagonally.

Step 02: Then it is folded again against the parting line as illustrated

Step 03: Cutting the given pattern, as illustrated in the Red colour

Step 04: Now unfold it in reverse so we get the same pattern but as **the mirror image**

Step 05: Then, opening it again, we find the pattern watered



Step Wise Illustration of Paper Folding and Cutting Exercise

Tips for paper folding & cutting type Questions: In most cases, the pattern unveiled after unfolding along each crease is the **Water Image** of the cut or drawn pattern.

Preparation Strategies

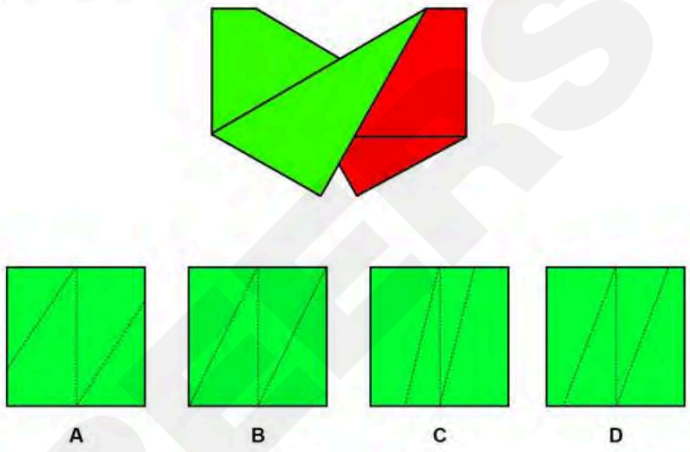
1. **Practice Regularly**: Dedicate time daily to practise different folding and cutting techniques. Regular practice helps develop muscle memory and precision.
2. **Use Different Paper Types**: Experiment with various papers, such as origami paper, craft paper, and even recycled paper. Different papers behave differently, providing diverse learning experiences.
3. **Follow Tutorials**: Utilise online tutorials and books for step-by-step instructions on various designs.
4. **Analyse Past Papers**: Review previous NID and UCEED papers to understand the types of questions asked. Focus your practice on these areas.

Conclusion

For design aptitude exams like NID and UCEED, it is essential to become proficient in paper folding, unfolding, and cutting. These abilities improve physical dexterity, creativity, and spatial awareness—all vital skills. Aspirants can significantly increase their chances of doing well on these tests by practising frequently, experimenting with new strategies, and reviewing previous exams. So take a piece of paper, begin to fold, and let your imagination go wild!

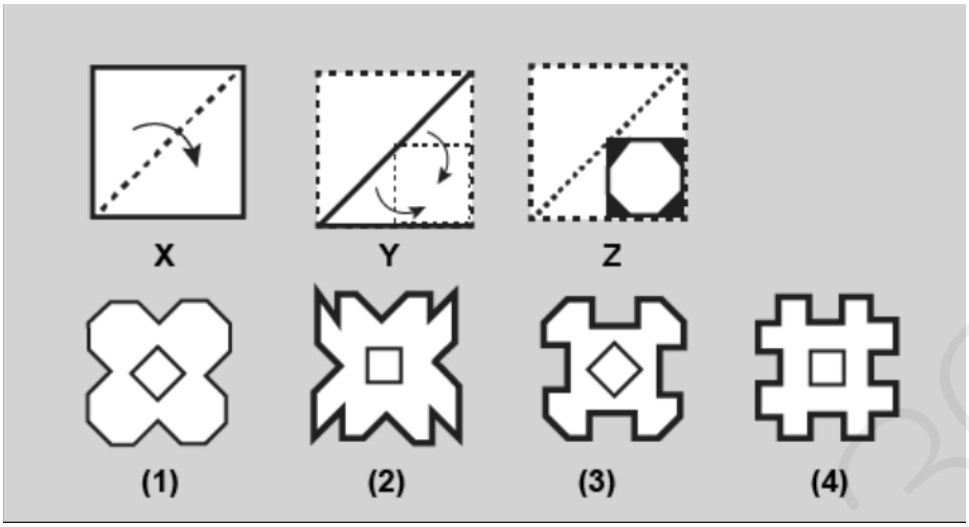
Important sample questions from NID/UCEED

Q.1 Below is a folded sheet of paper with green colour on one side and red on the other. Dotted lines represent the fold lines. Which option shows the correct fold lines when this sheet is unfolded



***Hint** - Analyse the dotted fold lines to visualise the unfolding process, and compare the unfolded sheet with options to ensure fold lines align correctly.

Q.2 Choose the figure from 1, 2, 3, or 4 closely resembling figure Z.



*Approach - Start by making the reflection of the cutout part while unfolding it.

Visualisation Analogy: Piece Matching & Tangram Puzzles

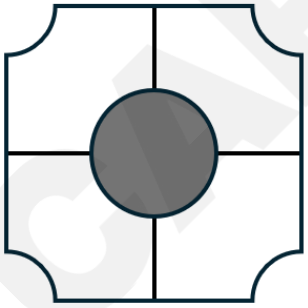
A graphic understanding of "Matching the Pieces and Parts" as an assessment determines the pupil's mastery of where to place the missing pieces to complete a specific figure. This reduces the time needed to develop pattern recognition, spatial visualisation, and other skills to pass the design aptitude tests (DAT). This activity is relevant for DAT tests because it makes students comprehend how forms fit together. Therefore, aspiring designers must understand this since it mimics the real-life responsibilities of putting together, designing, and conceptualising design.

Introduction

For establishing effective and strong visualisation, it is the visual analogy-based question for matching the figures which help in the observation of the similarities and differences in the given figures. This question serves in an applied manner, where one has to remember counting on the piece and the shape of those pieces, as well as the application and approach we shall understand in this study material. We must now learn the various types of questions to be asked.

1. **Visualising the part for the given parent/master figure.**
2. **Visualising the Master/Parent image from the given pieces.**

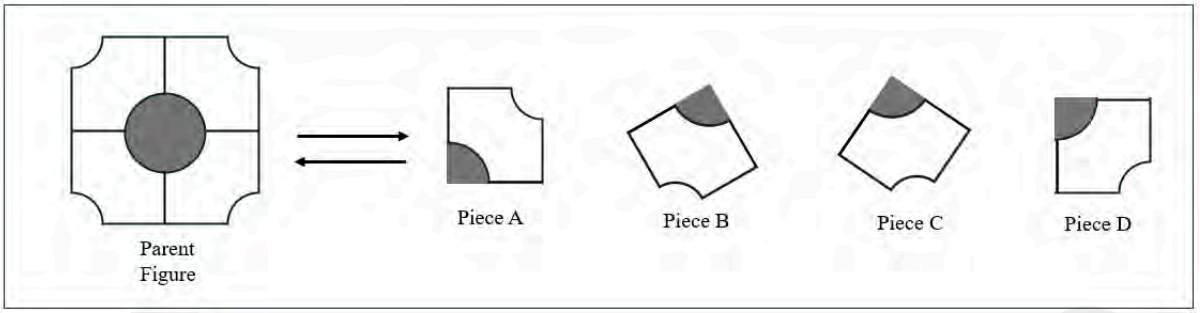
Let's Understand the types of questions through the examples.



1. Visualising the part for the given parent/master figure.

Here, a parent/master figure is given on the hand side and is split into four or more pieces, and the aspirant has to identify the correct combination of pieces that could come together to make this master figure.

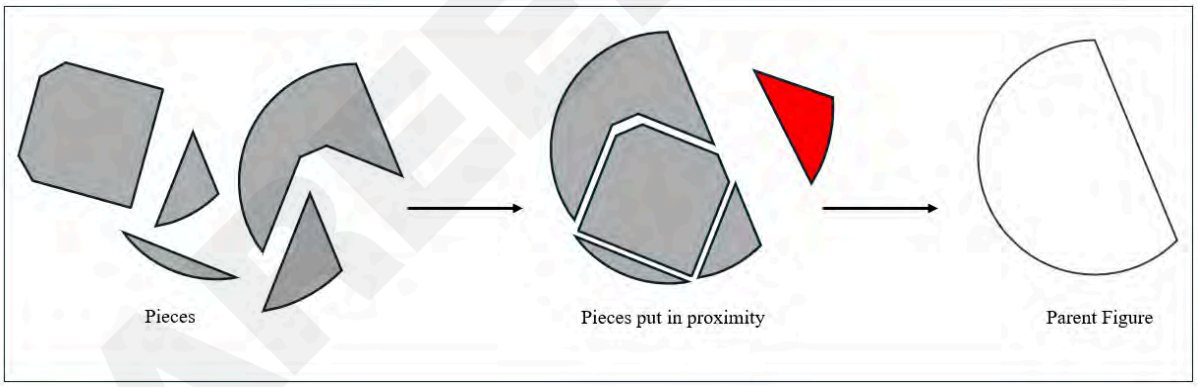
For simplicity of understanding, the image is broken down into four pieces, as shown below for your reference, which could combine to make the main figure.



2. Visualising the Master/Parent image from the given pieces.

The question may be asked interchangeably by providing the pieces of a figure, and the aspirant/student may be asked to guess the correct figure from the combination of the given pieces.

 # Note: Sometimes, an additional piece is provided, as shown in the intermediate step, to test the visual memory of the aspirant. Here, the red piece**(Distractor)** is an extra piece to disguise the viewer.



Step By Step Approach to Attempt the Piece Matching Exercise

Step 1: **Take note of the Master Figure.**

Identify the critical details like the number of sides and angles in the given the figure, the symmetry(if any), and distinct lines in the figure.

Step 2: **Examine Every Choice in Answers**

Examine each choice that is listed on the right. Examine the differences

between the master figure and the shapes, sides, and angles.

Step 3: **Alignment with the Direction**

If possible, verify which options need to be flipped or rotated so they line up with certain portions of the master figure.

Step 4: **Testing to Fit**

Put each choice in your visualisation from the master figure. Suppose each component would fit into the master figure as follows ask for the following questions :

4a. Does the piece given fit into alignment with the master figure?
4b. Does it fit the existing lines and edges perfectly?
4c. Remove the choices that don't fit or have odd angles or sides.

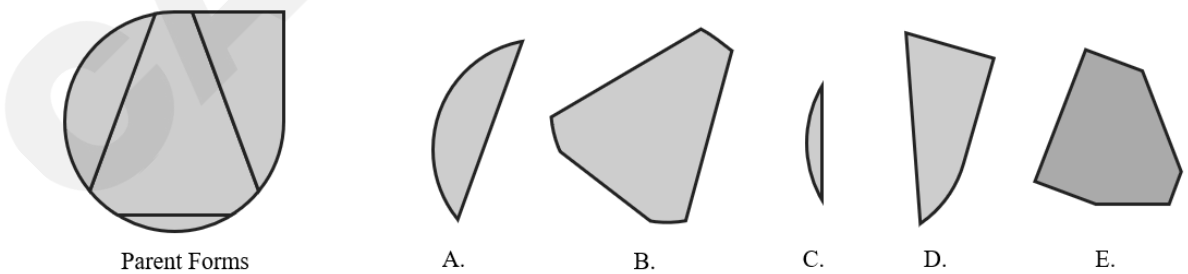
Step 5: **Discard Wrong Choices**

Reject the options that seem unfit to the question based on your observations. Pay attention to those that appear to match the dimensions.

Step 6: **Match the Correct Option**

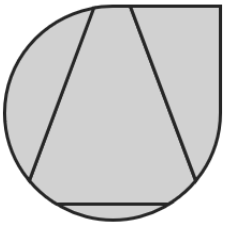
After removing all of the wrong options, cross-check the revealed option that It completely suits the master figure to the best of my abilities.

Let's understand the approach through an example:



Q: Looking at the pieces on the right, identify the option that does not qualify to be part of a combination forming the parent figure on the left.

Step 01: Understand the master figure.

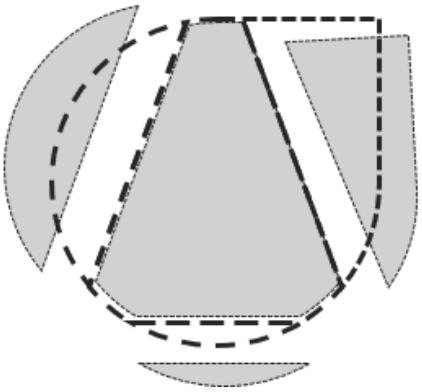


Parent Forms

Step 02: Examine all the given options in the answer choices as given
Also, count the number of pieces possible, i.e. four, whereas in
In the answer options, there are five figures.

A. B. C. D. E.

Step 03: Mentally visualise and try to align the pieces to fit together and identifying
The additional piece that is provided and not fitting the arrangement.



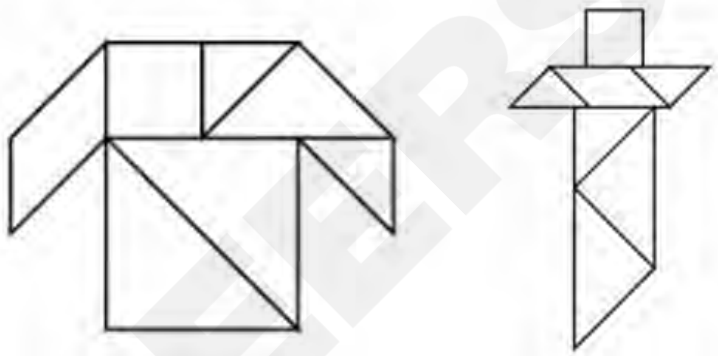
Step 04: Test fit the possible options to combine and make the parent figure as given in the question.

Trick: "Quickly Try to Doodle for finding the right option."

Step 05: As per the possible combination of the options, option E. does not qualify to be part of the arrangement.

Introduction to Tangram Puzzles

Tangram puzzles are traditional Chinese geometric puzzles from the 960s–1279s AD Song Dynasty. **The Tangram, sometimes called the "Seven Boards of skill," is a puzzle that originates in China**.



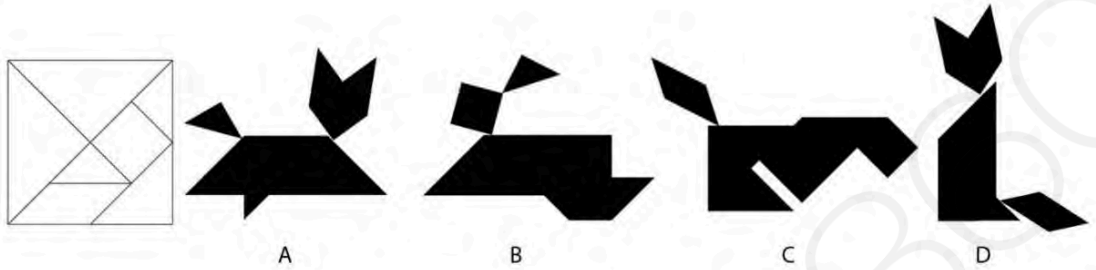
Examples of Tangram Puzzles

It comprises seven flat pieces, or tans: five triangles, one square and one parallelogram. The primary purpose is to swap the tans to make the figure as dreamed of desired shape or posture and without any tile overlap.

Understanding Tangram Puzzles is essential for DAT because they evaluate the person's basic design skills, such as geometry, spatial recognition, and critical thinking. Tangrams resemble actual jobs in design where building and visualising shapes form an integral part of the working process, which demands the ability to discern how particular shapes interconnect to constitute a figure.

Sample Question (Previous Year)

Q: A square is cut into seven pieces, as shown on the extreme left of the image. Identify which of the options can be made using all seven pieces.



Principles of Design

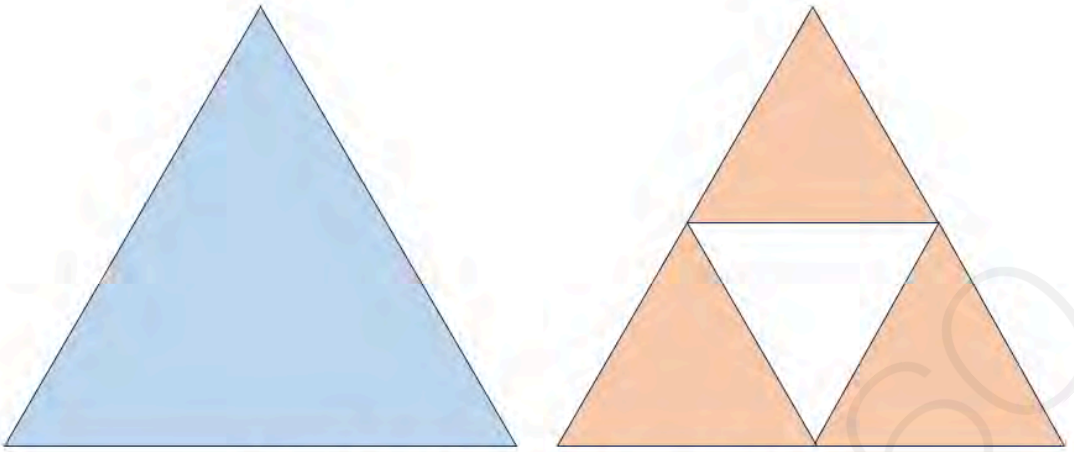
Design principles are the initial and basic or fundamental ideas which can be employed when developing aesthetics and effective design. Knowledge of these principles is crucial in the conceptualization of appealing and easy-to-use interfaces that conveys concepts successfully. In graphic designing, product designing, or even architecture, it is very important for the beginners or newcomers to the designing industry to understand the principles of design.

Five Important Principles of Design:

1. Balance
2. Rhythm
3. Movement
4. Emphasis
5. Harmony

Let's understand and acknowledge them;

1. **Balance** - The distribution of visual weight in a design, ensuring that no single element overpowers another, creating a sense of stability and equilibrium. For example, below, there is a blue triangle, which is visually balanced by three red triangles; this way visual weight is managed.

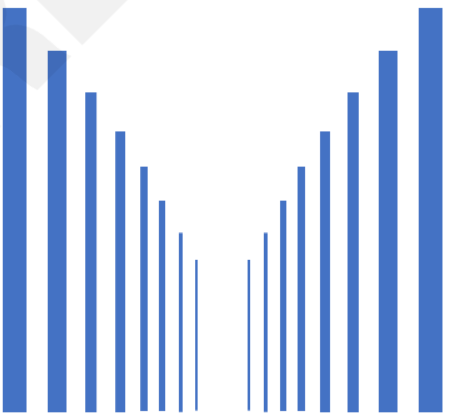


Balance is shown using different sizes of triangles

Types of Balance:

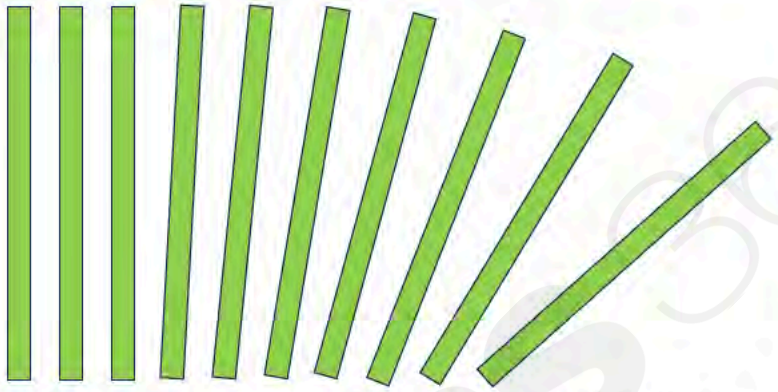
1. Symmetrical Balance: Equal elements on both sides, like a mirror reflection.
2. Asymmetrical Balance: Unequal elements are balanced by size, color, and placement.
3. Radial Balance: Elements like a wheel radiate from a central point.

2. **Rhythm** - The repeated elements in a controlled and organized way, leading the viewer's eye through the design in a harmonious flow. For example, below, you can see the blue lines getting thin and far, which gives a feeling of flow and rhythm, just like in music and dance.



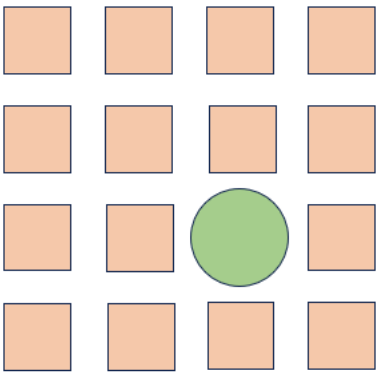
Rhythm is shown using lines that are getting thinner gradually

3. **Movement** - The viewer's eye across the design creates a sense of motion and directs attention to critical elements through strategic placement and use of lines. For example, below the green lines, we are about to fall; this gives a feeling of movement that leads our eyes in some direction of movement.



Movement is shown with the falling motion of lines in the downward direction

4. **Emphasis** - The most essential parts of a design are making it stand out through contrast, colour, or size, ensuring it captures the viewer's attention. For example, the red circle is seen below, followed by the blue square around it because the red circle is different in shape, size, and colour than the blue squares.

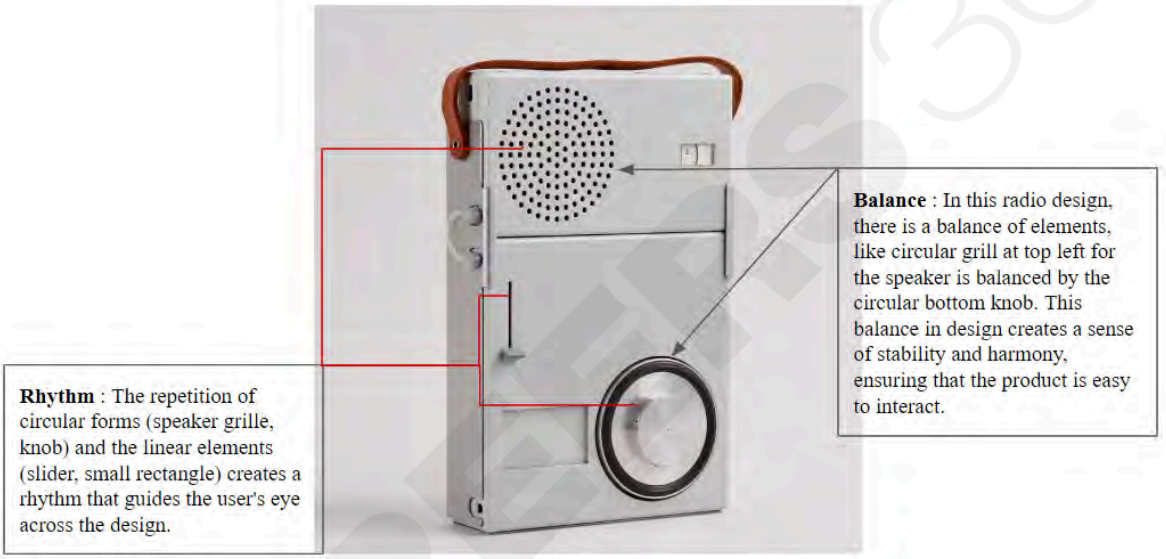


Emphasis is on the circle among the square

5. **Harmony** - The cohesive blending of elements to create a unified and aesthetically pleasing design, where all components work together seamlessly without conflict. For example, below, multiple circles are different in size and colour but are all placed together to look pleasing and soothing to our eyes.

Understanding of Design Principles for Good Design

Let's understand the concept with an example through, **TP 1 radio/phono combination, 1959, designed by Dieter Rams for Braun.**

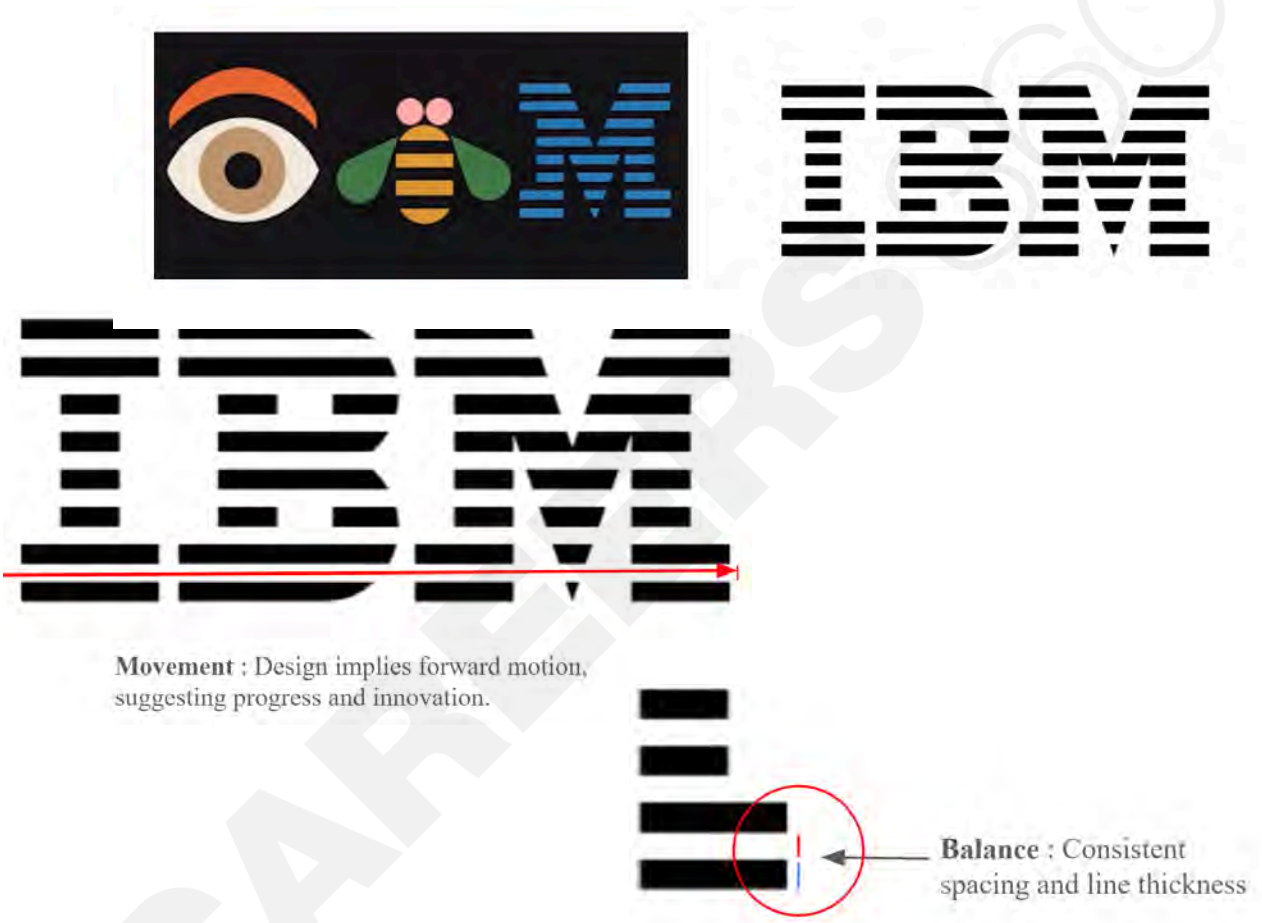


Product Design: Design Principles for Braun Radio: From the work presented by Dieter Rams, he created objects that were not only functional but also visually appealing, in addition to being functional and easy to use. Concerning harmony, movement, balance, rhythm, and accent, Rams saw to it that every design was optimised for the purpose it was intended but had that minimalist, modern design. Because he has a strong knowledge of design, he provides Braun with creative and sustainable designs.

This looks like a perfect design; it is reliable in terms of usability and also aesthetic durability and has a timeless appeal as can be evidenced from the pictured product.

Good Graphic Design: Design Principles

Let's Explore the Design principles in Paul Rand's **IBM Logo Design**

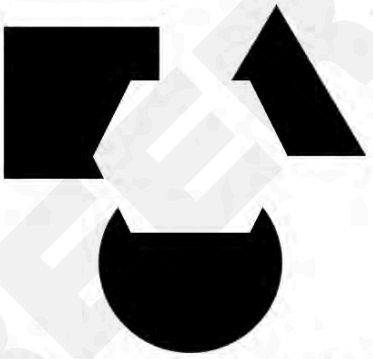


Gestalt's Law

Gestalt's Law, which states that **a whole is perceived rather than the sum of its parts.** These includes Proximity, Similarity, Closure, and Continuity are laws that explain how we sort information visually as well as how we make meaning of such images. Many laws play an important role in design, as it helps in constructing the easily digestible images which form the basis of most of the visually appealing compositions, and thus helps in shaping the easily comprehensible experiences.

Let's understand the following laws with example:

1. **Closure**
   Closure is the Gestalt principle where the human mind fills in missing parts of a design to perceive a complete, unified shape, even when it's incomplete.



Closure – Hexagon can be seen without even making it

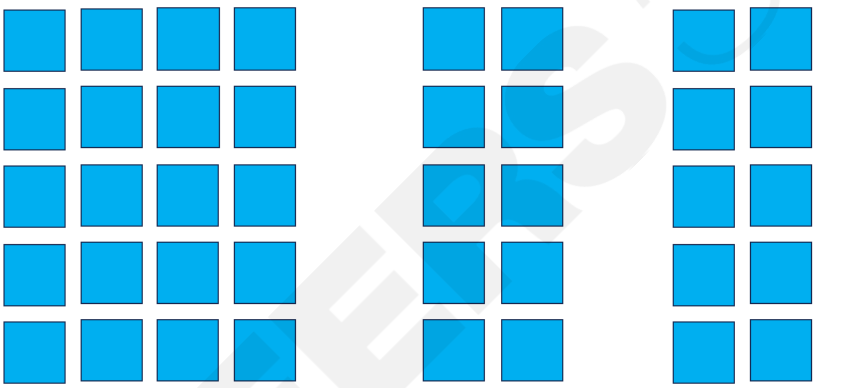
For example,there are squares, triangles and circles below, and we can see hexagons between them without being drawn.

2. **Figure and Ground**

The Figure and Ground principle explains how we distinguish objects (figures) from their surrounding background (ground), creating a sense of depth and focus in design. For example, the letters "h" and "r" can be seen, but it depends on the viewer what they perceive first; that becomes the figure, and the other becomes the ground.

3. Proximity

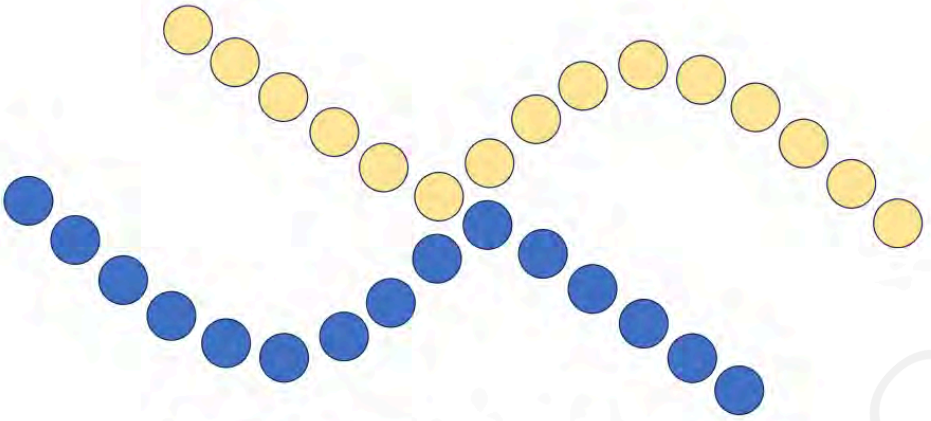
Proximity refers to the grouping of elements based on their physical closeness to one another. Elements that are close together are perceived as related, forming a cohesive structure. For example the blue squares on the left are seen as one whole together because of their placement, whereas on the other hand there is a gap between which makes two separate groups on the right.



These all are perceived as one whole **These are perceived as two different groups**

4. Continuity

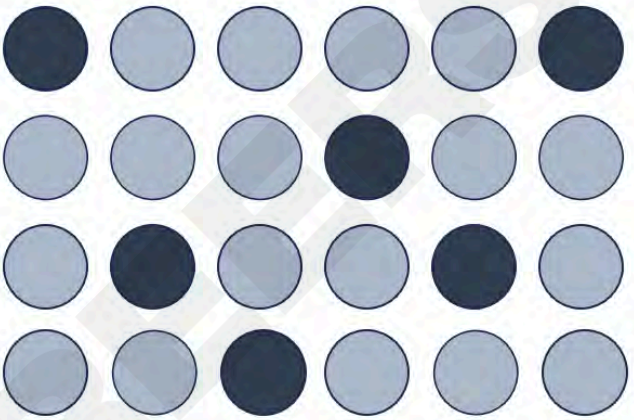
Continuity is the principle where the eye naturally follows a path or line, leading it through a design in a smooth, flowing manner, creating a sense of movement and direction.



Continuity is shown through dots placed in a sense of a direction

5. **Similarity**

   The Gestalt principle of similarity states that elements that are similar in appearance are perceived as part of the same group or pattern, creating a sense of unity in design.



Similarity is shown with circles

Best example to understand all the principles:

Book cover of **"Peter and the Wolf**" by Phoebe Morris

The Design Principles and Gestalt's law, which are applied and kept into mind while making this;

Analysis of Book Cover by Gestalt Principles:

1. **Figure and Ground:** The figure is represented by the contours of the wolf's image while the boy's silhouette creates the ground.
2. **Closure:** One fills in the missing details that a mere sketch of a boy was providing and a near complete person is formed in the mind.
3. **Proximity:** The head of the wolf and the bird are near each other, which suggests that they have communicated.
4. **Continuity:** Using a curve, one can easily follow the smooth line of the wolf across the whole design.

Design Principles:

1. **Balance:** This is asymmetrical balance since the light grey-colored wolf is large and is flanked by the darkness of the negative space surrounding it.
2. **Emphasis:** The placement of this title enhances the focus on the boy that has been created with the help of a negative space.
3. **Contrast:** A bright background also emphasises the key features and main object, which is the dark-coloured wolf.
4. **Movement:** This design makes the viewer's eye move from the wolf's head to the bird, providing continuity.

Conclusion

Knowledge and application of design principles are essential in designing any layout with suitable structure, appearance and functionality. These principles will be useful as a framework heading into the NID and UCEED and will be able to guide creativity and thought processes as well as helping articulate ideas. Learning balance, rhythm, emphasis and, most importantly, harmony will help you create designs that are attention-catching as well as informative. The above-stated skills will be very useful in your journey as a designer.

Data Sufficiency

Two of the assessment elements widely applied in DAT exams are information provided compared with asked logic to justify the answer, which reflect the candidate's capability of quantifying whether the data provided is sufficient to solve a given problem. In this section, a student's ability for critical analysis, logical approach to the problem, and capability to choose the relevant information from the given information set is being checked.

Data sufficiency tests are different from other problem-solving aptitude tests where a candidate is supposed to identify whether or not the problem can be solved using the available data without necessarily solving it.

Different Types of Questions: Data Sufficiency

Commonly, there are 04 types of questions asked in the Design-Aptitude Exams conducted by various organisations. There may be more than four types of questions. However, the most relevant to the topic are the following types of questions:

1. **Basic Logic and Reasoning**
2. **Numerical and Quantitative Reasoning**
3. **Pattern Recognitions**
4. **Spatial Reasoning**

Let's Try to understand each type with the relevant examples.

Type 1. Basic Logic and Reasoning

Basic Reasoning and Logic questions in data sufficiency evaluate a candidate's capacity to derive the logic and thus conclude from the information given in the question.

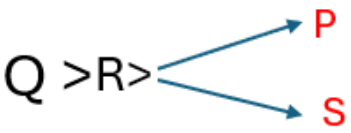
For example, deducing which statement is required to conclude from the given statements.

Q1: Who is the tallest among the four brothers, P, Q, R, and S?

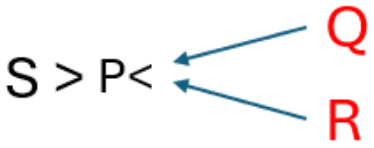
Statement 1: R is shorter than only Q
Statement 2: S is taller than only P

Conditions are given as,
i) Statement 1 alone is sufficient

ii) Statement 2 alone is sufficient
iii) Both Statement 1 and Statement 2 together are sufficient
iv) Both Statement 1 and Statement 2, even together are not sufficient.



From Statement i, alone we can conclude Q is tallest of them all as decoded in the figure.



From Statement ii, it can clearly be concluded that P is the shortest, but the information for tallest is still insufficient from this statement

SOLUTION: From the above two statements, it is clear that information from statement I, alone is sufficient to identify the tallest among the four brothers **thus, Option (i) is the right answer.**

Type 2. Numerical and Quantitative Reasoning

Numerical Data Sufficiency section, evaluates the numerical and quantitative reasoning to check a particular candidate's ability to decide whether the given numerical or quantitative data is sufficient to solve a certain problem. Arithmetic problems sometimes with measurements, areas, quantities, proportions and other characteristics that can be measured are often incorporated in these problems.

Condition: For a more clearer explanation, let us understand through an example where the dimensions of the , the rectangle and the triangle are known and the width of the rectangle and the height of the triangle are not given.

Problem Statement

Is the area of the rectangle greater than the area of the triangle?

Statement 1: The rectangle's width is twice the triangle's height.
Statement 2: The rectangle has a surface area of 96 square centimetres.

Conditions:

i)	Statement	1	alone	is	sufficient.
ii)	Statement	2	alone	is	sufficient.
iii)	Both	statements	together	are	sufficient.
iv)	Each	statement	alone	is	sufficient.

v) Neither statement is sufficient.

SOLUTION:

Step 01: Interpretations of given Statements

Statement 1. Alone doesn't fulfil the condition to find the triangle height,
Statement 2. The rectangle has a given surface area of 96 square cm(Centimetres)..

Area of Rectangle(96) = L X W
96 = 12 X W
Width (W) = 8 cm.

But still, the comparison is not feasible for not having the sufficient data required.

STEP 02:

2a. Checking to find the relationship between given statements, can this fulfil the Question requirements.

2b. Now, in statement 01, the relationship is given, "**The rectangle's width is twice the triangle's height,**" and thus making the comparison of areas possible.

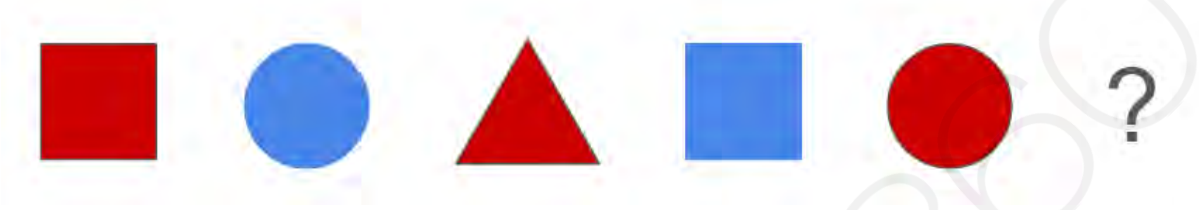
To conclude, condition iii) Both statements are sufficient and the correct answer.

Type 3. Pattern Recognitions

The capacity to recognise and comprehend recurrent themes, patterns, or arrangements in a series of shapes, numbers, or symbols is tested in data sufficiency courses using pattern recognition. Applicants must decide if the provided data is adequate to identify the underlying trend.

Let's understand with a Sample Question

Question : Looking at the following sequence of shapes, Based on the pattern, what is the next shape in the sequence ?



- **Statement 1:** The sequence alternates between two colours: red and blue.
- **Statement 2:** The sequence alternates between three shapes: square, circle, and triangle.

Conditions:

i) Statement 1 alone is sufficient.
ii) Statement 2 alone is sufficient.
iii) Both statements together are sufficient.
iv) Each statement alone is sufficient.
v) Neither statement is sufficient.

Solution : Analysing the Patterns based on information from the given statements.

C. From Relative Analysis of Statement 01 :

Red and Blue figures are taken in turns in the sequential manner. This assertion comes in harmony with the noted pattern whereby each step has got its colours being red and blue in an alternating manner. But this assertion by itself does not qualify for guessing the next shape. . Altogether, **Statement 1 only is insufficient**, although it predicts the colour, it does not help to establish the shape in any way.

Analysis of Statement 02 :

Three shapes are alternated in the sequence: They include; triangle shape, circle shape, and square shape. This pattern is repeated within the sequence and it starts with a square, then circle, triangle and then back to square, circle. It doesn't however tell you what colour the following form will be.

In conclusion, Statement 2 alone is insufficient while it could help verify the shape, it gives no hint in identifying the colour.

Combined Analysis of Statement 01 & Statement 02:

- The series of forms (square, circle, triangle) and the sequence of colours (red, blue) align to anticipate the next shape in the sequence when both statements are combined.
- The last shape in the sequence is a red circle. Following the colour pattern, the next shape should be blue. Following the shape pattern, the next shape should be a triangle.
- **Final Conclusion : The sum of the two statements is sufficient**. (A blue triangle will be the following shape in the sequence.)

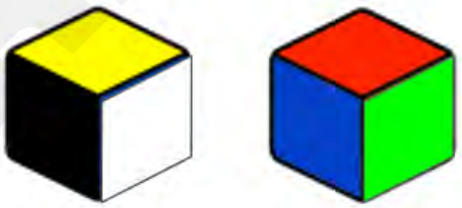
Type 4. Spatial Reasoning

Spatial Reasoning part of data sufficiency, which challenges the cognitive aptitudes of visualisation based questions, objects-in-space, manipulation, sample questions will centre on spatial intelligence. This also determines the perception or position of shapes, objects or spaces in relation by concerning the ways they fit or align.

Unlike other types here the visual clues and the information given are evaluated in comparison to the given statements.

Let's understand with a Sample Question

Question : You are given a cube that has its **6 faces painted with different colours: Red, Blue, Green, Yellow, White and Black.** The cube is rotated along the different axis. Determine which colour will be on the top after a series of rotation.



Problem Statement:

- What colour will be on the top face after the cube is rotated 90 degrees to the right and then 180 degrees upward ?
    - **Statement 1:** Initially, the Red face is on top.
    - **Statement 2:** The Blue face is on the front.

Conditions:

i) Statement 1 alone is sufficient.
ii) Statement 2 alone is sufficient.
iii) Both statements together are sufficient.
iv) Each statement alone is sufficient.
v) Neither statement is sufficient.

A. ***Analysis of Statement 01 :***

We can deduce the new orientation following the rotations by knowing that the Red face is initially in the lead, but in order to calculate the final location of the faces, we also need to know which face is in front. Thus **Statement 1, alone is not sufficient.**

B. ***Analysis of Statement 02 :***

Knowing that the Blue face is in the front initially, we can figure out the relationship between the front and top faces, but we need to know the initial top face to track the rotations. Thus **Statement 2, alone is not sufficient.**

C. Combined Analysis of Statement 01 & Statement 02

It can precisely be identified from the information provided in the beginning that the top is (Red) and the front face is (Blue).

From this it can be concluded that The option (iii) The sum of the two statements is sufficient. Yellow is the last top face to appear in the end post rotations.

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Warm Regards
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